

***A TRAINING PACKAGE ON GEOGRAPHY FOR
THE SOCIAL SCIENCE TEACHERS AT
SECONDARY LEVEL
[KERALA AND PONDICHERRY]***

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PREFACE

In most of the southern states, the Geography discipline is being taught by non-Geography teachers at secondary level. Geography is an applied science which needs more enrichment in content and proper methodology while teaching at secondary level. Hence, it is proposed to provide content enrichment and proper methodology with appropriate teaching aids to the secondary teachers along with training module.

This module has been prepared under Programme Advisory Committee on request of Kerala State Educational Department during the State Co-ordinate Committee meeting. The similar activity was proposed by the Pondicherry Education Department. Hence it was decided to conduct a common programme for both States and also on capacity building.

At a first step, the Academic Coordinator had met the State Educational Functionaries of Kerala and had discussions with the secondary grade teachers of government schools who are dealing with the social science along with the faculty of SCERT and other Training Institutions. After having discussions, the participants identified difficult areas where they have difficulties in transaction the content in the class room situations. Some portions of the Geography units especially Physical geography and Map Reading which are usually considered as technical and scientific oriented have been considered. In this present volume, the Human Geography and Regional Geography were not discussed due to paucity of time.

In the second stage, Resource Persons {RPs} participated from Kerala, Tamilnadu and Pondicherry for the preparation of 'Training Package'. During the work shop a detailed design [guideline appended] of 'Training Package' has been provided to the participants. The entire Training Package has been divided in to five modules viz. Atmosphere, Lithosphere, Hydrosphere, Biosphere and Map & Projection. After the discussions, it was decided to follow the items uniformly in the order given below:

- 1.1. Introduction of the subject
- 1.2. Instructional Objectives
- 1.3. Concepts [Major & Minor]
 - Logical Sequence of content
- 1.4. Development
 - {a} Methods
 - {b} Teaching Aids
 - {c} Activity Duration/Time
- 1.5 Evaluation items

As per above format, the 5 modules were developed in the Regional Institute of Education, Mysore and copies were made for tryout. Accordingly the Training Package were distributed to the Teacher Educators both in Kerala and Pondicherry for their suggestions for improvement. In order to find out the effectiveness of the package a profile [appended] using 5 point scale was circulated among the Teacher Educators during the workshop. The over all assessment has come positively with regard to sufficient material in content, clarity, error, logical sequence and appropriateness. Then the present final version was made.

The Training Module need to be referred along with the geography text books [8,9 &10 standards] of Kerala State. This present module is aimed at helping the social science teachers to understand the geographic concept easily and also to have additional information which is not available to them in the schools. This 'Training Package' can also be used as self learning materials. In most of the southern states the government schools has mostly regional language as teaching medium. Hence this module has to be translated in to the regional language and validation also should be obtained.

Place: Mysore
29th March, 2000

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Acknowledgement

I take this opportunity to express my sincere gratitude to our Principal, Prof. G.Ravindra for his constant encouragement throughout this programme.

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My sincere thanks to Prof. S.N.Prasad, Prof. Dr. K.Duraisamy, Dean of Instruction, Mr.K.P.Sankaran, Dr.S.G.Gangoli, Dr. N.N.Prahaladha, Dr. R.Narayanan, Dr.S.S.Rahavan, Dr. G.V.Gopal, Dr.G.P.Basavaraju, and Dr. V.V.Anand of RIE, Mysore for their relentless advise and help.

In thank the State Educational Functionaries of Kerala, Tamilnadu and Pondicherry for providing all the required assistance and facilities.

Finally I thank Mr.A.Ramadas, Principal, DIET, Pondicherry, Prof. A. Balasubramaniam, Department of Geology, Mysore University, Dr.C.K. Sankaran Nair, F.A. Trivandram, Dr.P.Veerappan, F.A., Chennai, Ms. Suma Emban, Lecturer, Maharan college, Mysore, Ms.M.Banumathy, Lecturer in Economics, Nirmala College, Coimbatore, Mr.J.Manikandan, DIET, Pondicherry and all the Resource Persons and Teacher educators for their valuable support in completion of the training package.

Place: Mysore
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GUIDELINES FOR PREPARATION OF TRAINING PACKAGE

The resource persons are requested to follow the guidelines and format given below for the preparation of 'Training Package' [TP].

- * The main purpose of the training package is to assist the social science teachers of secondary level in familiar with the content and method of his teaching particularly in geography.
- * As the method is woven into the subject content [matter], the TP has to be both a text and a teachers' guide.
- * Each chapter should be in *sequence order*, with a *brief introduction*, a list of major *instructional objectives*, a list of *key concepts* to be developed, *comprehensive development of the subject content*, additional *activities* and a set of *questions* and *exercises*.
- * The introduction should define the scope of the chapter, an overview of the subject content and need the chapter in the proper perspective in relation to other chapter in the unit.
- * The statement of instructional objectives should constitutes a vital part of each chapter. The major objectives pertaining in the subject content are enough.
- * The objectives has to be in *three* hierarchical categories – knowledge, understanding and application.

These three categories are further has to be divided into a series of heirarchical Expected Learning Outcomes as follows:

Objective category	Expected Learning Outcome
1. Knowledge	Recognition Recall
2. Understanding	Seeing relationship Citing examples

Discrimination
Classification
Interpretation
Verification
Generalisation

3. Application

Reasoning
Formulating hypotheses
Inference
Prediction

From the statement of instructional objectives in the TP teachers can make out not only the expected learning outcome but also the objective category to which the outcome belongs. Learning outcomes under the knowledge category are the easiest to achieve while those under the Application category are the hardest to achieve. Hence it is requested to simplify the matter. A list of key CONCEPTS, in the sequence of their development in the text, follows the list of objectives. These are to be developed through the instructional process.

The next section DEVELOPMENT which follows in most of the chapter. The subject content has to be divided into a number of convenient sections and subsections. In keeping with the modern approach to science teaching, the development of concepts has to be attempted through student-learning activities, teacher-demonstrations and class-room discussions. It is a well established fact that the depth of understanding achieved by 'doing' is far greater than that achieved by passive listening or observing. This is the basis of the activity approach which has to be built into the TP. The role of the teacher in guiding the students effectively through the activities is centrally important. In view of above, the appropriate activities has to be written in the form of instructions to the teacher.

Many of the activity may be consist of simple class-room experiments/exercises in which students can participate actively/effectively. Some activities may also prepared to lend themselves primarily to demonstration by the teacher, with little student participation. It is necessary to keep in mind that the large majority of schools in India are rather poorly provided the required apparatus. Hence, the activities require material which are commercially available at reasonably low cost or which can be improvised with a little effort from commonly available materials.

RPs may give more activities designed to develop the *same* concept.

It is known that an effective handling of the class-room discussions is equally important for the attainment of higher learning outcomes. The teacher should strive to create an open, permissive class-room atmosphere which would be conducive to learning through student teacher *interaction*. Hence is requested to include a number of sequential developmental questions at crucial stage in the activities and discussions. The teacher can employ these questions to initiate class-room discussions and thereby lead students towards higher learning goals.

It is requested to note that the activities and discussions follow a logical sequence, generally conforming to the sequence of instructional objectives.

Some additional activities can be added on each chapter which may serve many purposes viz. Supplementary the activities in the main text, alternative activities and teacher may give as special assignments to students.

Each chapter should end with the section of Questions and Exercises. The repetitions of questions will improve quite challenging among students. RPs has to provide useful tools for the evaluation of students achievement at the Understanding and Application levels. For the teacher's ready reference, hits, concise answers has to give to most of the questions and exercises. It is left to the teacher to select of the exercises and questions for use at appropriate stages during the course of development of the lessons.

The TP which will be prepared primarily intended for the practicing teacher, the TP can also be used effectively by educators and trainees in teacher training institutions. They will find it easy to evolve lesson plans geared to specific learning outcomes, unit plans and resource units from the material in the proposed to develop TP.

It is suggested that the TP may necessarily student-text catering to the curriculum of any particular school system. It should be a comprehensive resource handbook meant for teachers. The teacher expected to *select* the appropriate material from the TP and *tailor* to the fit his class-room needs. The instructional objectives and concepts has to be listed at the beginning of each chapter would help him in his selection. The material is meant as much for the teacher's own enrichment as for his class-room use.

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ATMOSPHERE

THE ATMOSPHERE

Introduction

Every one of us breath air, which we cannot see or smell, but we feel its presence. Air is present all over the earth. The vast expansion of air which envelopes all round the earth is called the atmosphere. It contains life-giving gases like oxygen for humans and animals, and carbondioxide for plants. It acts like a green house by trapping the heat. As in a glass room, in a green house it allows short wave radiation to enter it and reach the surface of the earth. But it is nearly opaque to long wave terrestrial radiation and thus keeps the earth's average temperature as 35°C .

It protects the earth from the harmful radiation from the sun. It also serves as a storehouse for water vapour which leads to precipitation, fairly distributed over ponds and sea. Air currents and winds within the atmosphere regulate the temperature on earth and prevent places from getting continuously hotter or colder.

The atmosphere extends to thousands of kilometer. Although 97% of the mass of the atmosphere lies within 29 kms of the earth surface. But it has no clear cut upper limit and it gradually merges with the outer space. In the highest levels gases are extremely rarefied.

Instructional Objectives

1. To realise the atmosphere as a gaseous envelope.
2. To understand that the earth is the only planet which has got suitable atmosphere to support life.

3. To understand that the air is a mixture of different gases.
4. To realise the presence of water vapour, dust, etc. in the air.
5. To understand different sections of atmosphere.
6. To know the thickness of air and their variation in different places.
7. To discriminate the atmospheric layers in homosphere.
8. To realise the nature of troposphere and green house effect.
9. To realise the stratosphere, mesosphere and thermosphere.
10. To discriminate the atmospheric layers in hetrosphere.
11. To interpret the ozone layer and ionosphere.
12. To understand the importance of ozone layer.
13. To realise the 'global warming'.
14. To interpret, how the ozone hole is formed ?
15. To realise the importance of ionosphere.

Concepts

1. The atmosphere is the envelope of air that surrounds the earth.
2. The earth is the only planet which has got the suitable atmosphere to support life.
3. The air is a mixture of different gases.
4. Water vapour and dust are present in the air.
5. The atmosphere can be divided into two main types as homosphere and hetrosphere.
6. The density, thickness and pressure of air vary from place to place.

7. Four different layers are present in the homosphere.
8. Green house effect occurs in troposphere. Green house effect destroy ecological and environmental balance.
9. Hetrosphere has got four different layers.
10. Ozone layer consists of (O_3) molecule.
11. Ozone layer shields the earth by preventing harmful rays from the sun and regulating earth's temperature.
12. Ozone hole is the cause for 'global warming'.
13. 'Trace gases' (C.F.C.) is the cause for destruction of ozone molecules which become ozone hole.
14. Ionosphere reflects the radio waves back to the surface of the earth.

Developments

Atmosphere

Recall what is air ? Can we see ? Can we smell ? All living beings breath air. We cannot see the air or smell it, only we can feel the air. By touching the air flow from our nose as well as blow of air from a running fan or outside tree leaves watching movements of we feel the flow of air.

Recall living and non-living things on earth. Ask students what is the most essential element without which living beings cannot exist ? Question them where is it to be found ? Explain to them that the envelop of air surrounding the earth is known as atmosphere."

To explain the location of air, prepare a thermocol cut-outs for the atmospheric envelop and fix it on the surface of the Globe and explain the presence of atmosphere.

Explain that scientific evidence has not yet been found to prove that no other planet is having atmosphere like ours. Only the earth is suitable for living. Recall people holding umbrellas even if it is not raining why? Protecting themselves from sun rays is the reason. Like this, we are using blankets to cover our body why?

Explain how atmosphere acts as a shield, protecting the earth from the direct rays of the sun and thus preventing it from becoming too hot as well as preventing it from becoming very cold by acting as a green house.

Explain how the air current regulate the temperature of the earth.

Composition of the Atmosphere

Show the nitrogen cycle chart and explain. All living beings basically need nitrogen. The bacteria absorbs nitrogen and fix it as nitrate in the soil. All plants utilise it to grow. When lightning occurs nitrogen gets mixed with oxygen and form nitrates and this nitrate gets dissolved in the rain water and form as diluted nitric acid. If this acid is mixed with calcium, it becomes calcium nitrate. This will be very useful for plant growth. Nitrogen is converted into protein in the plant. So it is essential for all plants and animals.

After the death of a plant or an animal, its body decays and decomposes into nitrogen gas, which again sets mixed in the atmosphere. This nitrogen constitutes about 78 per cent of gases in the atmosphere.

How do you find oxygen in the air ?

Bring a small glass jar, put a lighted paper piece into the jar. Make the students observe carefully. Take another paper piece and burn it outside the jar. Now close the jar with your hand tightly. Within a few seconds paper burning in the jar stops burning. At the same time the paper burning outside the jar continue to burn. From this, enquire why the paper in the jar stops burning and the outside paper kept outside is burning still ?

Oxygen is the only gas which helps burning. Ask the students why we are breathing ? Can we live without breathing ?

Recall photosynthesis test in science. The oxygen released when photosynthesis process takes place, explains the presence of 20.94 PC oxygen in the atmosphere.

Recall the smoke from burning. Explain it as a heavy mixture of carbondioxide. Take a small test tube and put some diluted calcium carbonate water. Make the students breath out into the test tube. What will happen to the calcium carbonate water ?

The presence of carbondioxide makes the calcium carbonate water to be in milk white colour. When breathing out we and other living things are releasing carbondioxide. This explains the presence of carbondioxide in the atmosphere.

Ask why on some cloudy days we sweat ? Explain that carbon absorbs solar heat energy and accumulates heat

energy. If increases carbondioxide in the air and as a result of it the air temperature increases.

Water Vapour and Dust

Recall how water vapour from boiling water mixes with air and disappears. Where does this water vapour go ? To explain the presence of water vapour in the atmosphere the following simple experiment can be done in the class.

Take a tumbler (eversilver or glass) and put some ice cubes in $\frac{3}{4}$ of the tumbler. Wait for 5 or 10 minutes. What will happen in the outer surface of the tumbler ? There will be tiny drops of water. From where does it come ? Explain that the tiny drops of water comes from the water vapour in the air.

We are drying wet cloth on a rope. After some hours the water in the cloth disappears and the cloth becomes dry. How ? Who takes away the water ? Explain that 16 million tons of water evaporates from the earth's surface. Explain the different sources of evaporation. 1. Water bodies, 2. Plant respiration, 3. Animal Perspiration.

Dust

Recall from the students their observations on the road. Of what they see in air after the heavy vehicles have passed by ?

Ask them what they see in the sun rays which comes through small holes ? Have they noticed dust particles floating ?

Ask them what they see on chairs and tables in a room closed for days ? Dust. We can write on the table. Who spread the dust ?

Division of Atmosphere

Prepare thermocol models for the two layers and fix it on the Globe. Let the students to observe it and explain them in detail.

The atmosphere consists of concentric layers of air with varying degrees of density and temperature. Density is high near the earth surface and decreases while going up in the atmosphere. 97 pc of the total air mass of the atmosphere lies within 29 kms from the earth surface. The atmosphere is broadly divided into two parts as homosphere and hetrosphere.

Explain the nature of homosphere which is uniform in its chemical composition throughout 90 kms from the surface of the earth.

In hetrosphere the gases are seen in separate distinct layers.

The teacher can ask questions like Why Ooty is colder for discussion and make the students to apply their geographic knowledge to answer/participate. Explain that atmospheric temperature all over the atmosphere is not in a uniform pattern. Explain the "normal lapse rate" which is nothing but a decrease in the temperature while we go up in the atmosphere. According to Haurtwiz and Austin, the normal lapse rate in the lower few kilometers of the troposphere is $6.5^{\circ}\text{C}/\text{km}$ (or $3.6^{\circ}\text{F}/1000\text{ ft}$) while in the upper part is $7^{\circ}\text{C}/\text{km}$.

Draw a chart showing the different layers in the atmosphere as given below. (Fig. 1.1)

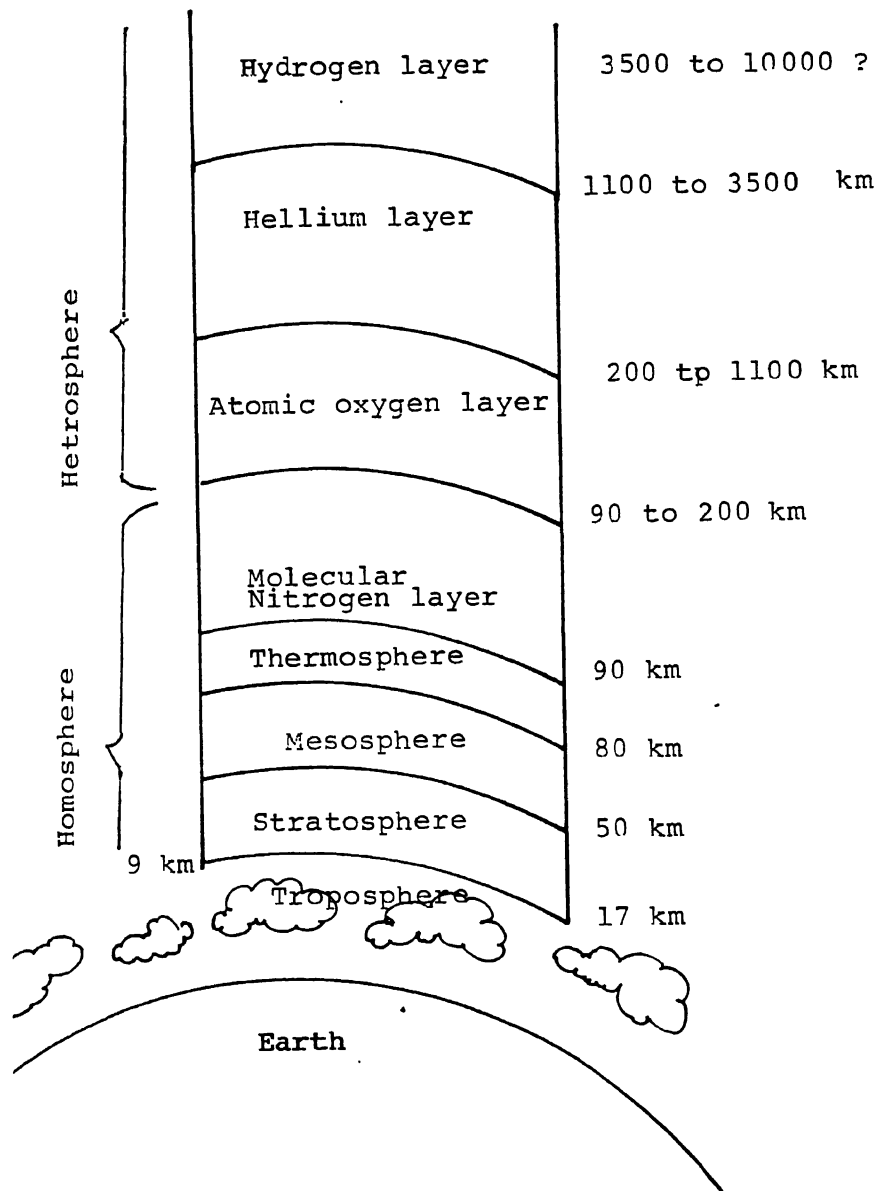


Fig. 1.1: Different Layers in the Atmosphere

Explain that the homosphere is divided into four different layers with reference to their thermal conditions.

1. Troposphere, 2. Stratosphere, 3. Mesosphere and
4. Thermosphere

By using a chart showing graphical representation of temperature the height of atmosphere can be explained.

(Fig. 1.2)

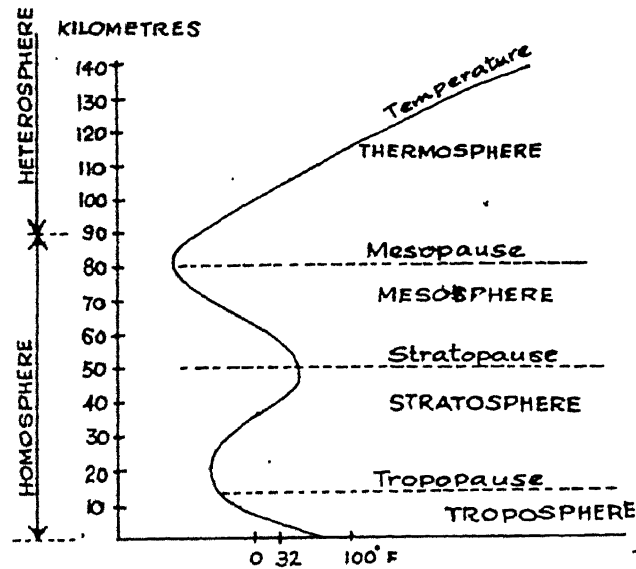


Fig. 1.2: Thermal Divisions of the Atmosphere

1. The Troposphere

Explain what are the qualities of troposphere. The lowest layer of the atmosphere is the troposphere. It is near the surface of the earth. It reaches to a height of about 17 km over the equator and 9 km over the poles. Troposphere contains almost all the dust and water vapour of the atmosphere and therefore contains nearly all clouds, precipitation and storms. Life activities of all the living organisms including man is present in this sphere only.

Troposphere and Green house effect

What is green house effect ? Have you seen Green house anywhere ? Why do we get more perspiration on cloudy days ?

Green house is a building/shed to grow and protect experimental plants from severe cold during winter. The roof

of this building is made of glass, so that over the weakest solar radiation can easily enter into the building through the glass roof.

The glass roof works as a valve. It permits the short wave radiation to pass through, but prevents long wave radiation from escaping through it.

How could it happen ?

The short wave radiation penetrates the glass roof when it reaches the surface of the earth. It will be absorbed and reradiated as long waves (infra red radiations) and it cannot penetrate the glass cover. So the temperature inside the building rises slowly, and thus plants can be saved from severe winter outside.

Cloudy days are warmer than the days under a clear sky. Do you know why ?

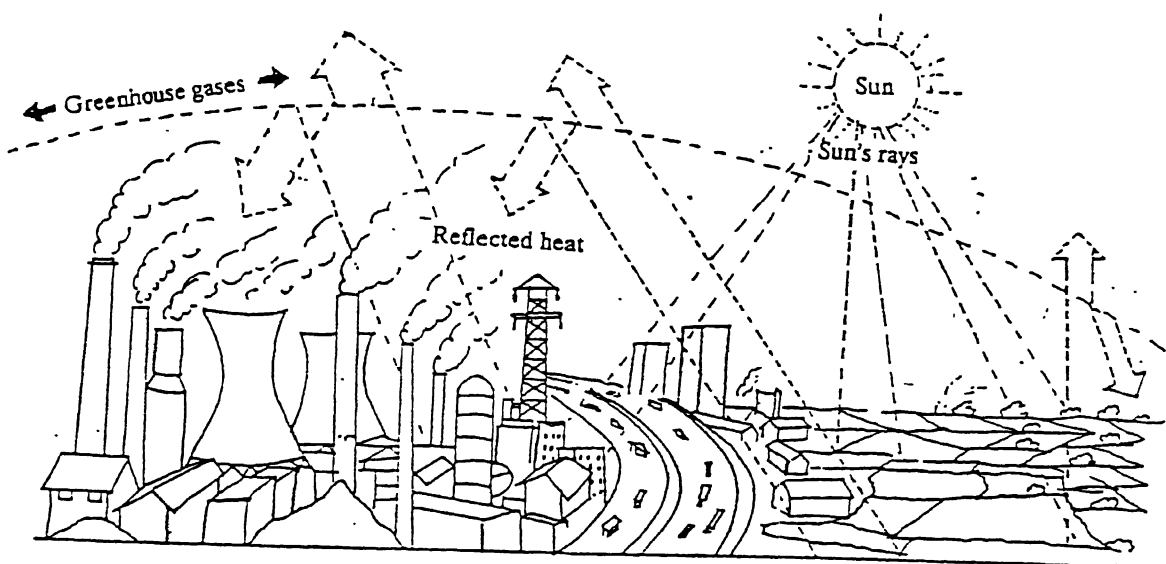


Fig. 1.3: Green House Effect

It is because of the green house effect. Troposphere in the atmosphere works as glass cover of a green house. It permits the short wave solar radiation to reach on the surface of the earth but prevents the long wave heat rays. If the impurities in the air, like carbondioxide, water vapour, dust particles, etc. increase, the possibilities of trapping down of long waves will also increase the heat. The rise in temperature will destroy the ecological and environmental balance.

2. The Stratosphere

What is the nature of stratosphere ?

The layer stratosphere lies over troposphere and extends upto 50 km. In the lower part of this layer, the temperature does not decrease with the increase in altitude but remains constant. However, a rise in temperature is observed in the upper part of this layer which is due to the chemical reaction by which oxygen is converted into ozone. Clouds are almost absent and there is very little dust or water vapour.

3. The Mesosphere

Above the stratosphere lies mesosphere. It reaches upto an altitude of (approximately) 80 km. The temperature tends to drop as the altitude increases as that is in the troposphere. At the top of mesosphere the temperature reaches down to a minimum of -83°C .

4. The Thermosphere

Above the mesosphere lies the thermosphere. The increase in temperature reaches over 700°C . Temperature

within the thermosphere can be obtained and used directly by the instruments mounted in rockets and earth's satellites.

B. Hetrosphere

Draw a chart as given in the figure and explain the layers to students.

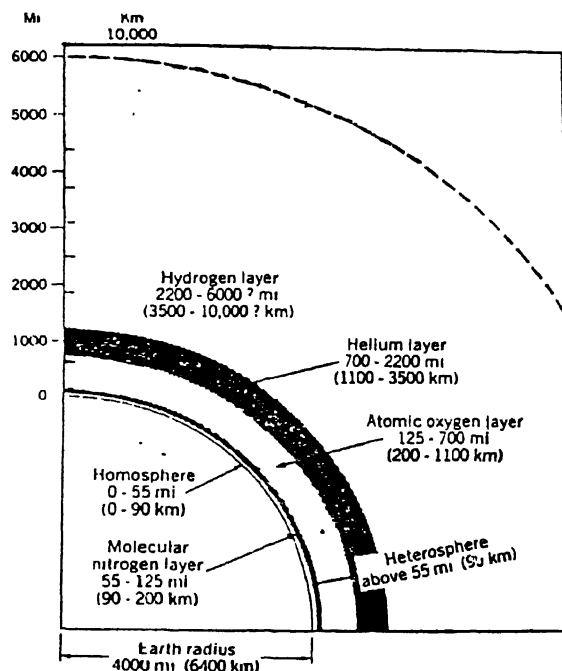


Fig. 1.4: Different Layers in the Atmosphere

Hetrosphere is called so, because the gases are seen in separate distinct layers. As seen in the figure, the various layers exist at different elevations. Hetrosphere is just above the homosphere. In hetrosphere there are four distinct layers, which are 1. Molecular nitrogen layer (90 to 200 km), 2. Atomic oxygen layer (ozone layer) (200 to 1100 km), 3. Helium layer (1100 to 3500 km) and 4. Hydrogen layer (3500 to 10000 km).

The ozone layer

What is the nature of ozone layer ? What is the importance of ozone layer ? How is it useful for us ?

The ozone layer is a protective cover surrounding the earth. The ozone layer contains a concentration of the gas ozone, a form of oxygen in which the molecule consists of three oxygen atoms (O_3) instead of two (O_2).

The maximum concentration generally occurs at about 20 to 35 km. The ultraviolet rays act upon oxygen molecules, causing them to split into single atoms. When a single oxygen atom collides with an ordinary two atom oxygen molecule, an ozone molecule is formed. The process is reversible, so that ozone eventually breaks down and re-forms into ordinary oxygen molecules.

The ozone layer shields the earth from the most harmful rays of the sun. Most of the sun's deadly ultraviolet rays are absorbed by this layer. Any chink in this protective ozone shield will wreak havoc, since the unleashed ultraviolet radiation will cause skin cancers, cataracts, and a general lowering of the ability of immune system to combat disease.

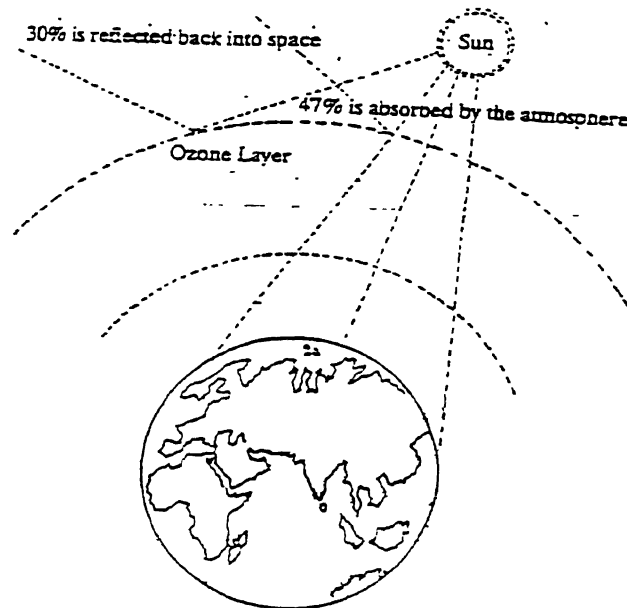


Fig. 1.5: Ozone Layer

Ozone layer and global warming

What is global warming ? How does it happen ? Ozone along with other gases such as carbondioxide, has an important role in regulating the earth's temperature and any change in its concentration can affect the world's climate.

In 1985 atmospheric scientists of British Antarctic survey published a completely unexpected finding that the spring time amounts of ozone in the atmosphere over Halley Bay Antarctica, decreased by more than 40 per cent between 1977 and 1984. This gradual decrease of ozone concentration led to the development of "ozone hole" over Antarctica. It is further reported that there is a similar ozone developing in the Arctic. Protective cover of ultra violet rays will disappear due to this. If ultraviolet rays

comes through such holes it can affect biological tissues of both humanbeings and plants.

A thermal expansion of the ocean due to ozone hole occur near the Antarctica would lead to slow but steady rise in the sea level. Melting of the Antarctic ice would also cause a rise in the sea level. Ports can go out of action, low lying areas would be flooded. This aspect is known as global warming. This is due to continuous exchange of infrared radiation between earth and the atmosphere. This exchange keeps the air temperature higher than it would be otherwise. So recall green house effect that makes the world warmer than before.

How is ozone hole formed ?

A serious danger to this ozone layer is posed by the release of freons - synthetic compounds containing carbon, fluorine and chlorine - atoms into the atmosphere. Compounds of this class are called "halo carbons" or chlorofluoromethanes (CFMs) or chlorofluorocarbons (CFCs) or Freons. Since the invention of CFCs in 1928, they have been used to cool refrigerators and air-conditioners, propel aerosol sprays, clean computer chips and make foam-rubber and the polystyrene containers common in food packing.

As chlorofluorocarbons rise into the atmosphere, they get exposed to increasing ultraviolet radiation and this cause ozone destruction. One chlorine atom can destroy as many as 1,00,000 ozone molecules. So these destruction of ozone molecules leading to the formation of a hole.

Students should be asked to observe the smoke emitted through vehicles, industries, etc.

Ionosphere

The ionosphere of our atmosphere is capable of conducting electricity. This characteristic makes long distance radio communication possible.

Molecules and atoms of nitrogen and oxygen of the upper atmosphere absorb the highly energetic gamma rays, X-rays and ultraviolet rays of the solar spectrum. In doing so, each affected molecule or atom loses an electron, becoming a positively charged molecule or atom known as ion. There is a region between 80 to 400 km above the earth where the concentration of positive ions and negative electrons is most dense. This region is known as ionosphere.

Draw the diagram (Fig. 1.6) and explain how electrons ejected from the molecules of oxygen and nitrogen during the ionisation process are free to travel as an electric current. Thus ionosphere is known as an electrically conducting layer and it reflects electric waves. Formation of ions in the ionosphere requires solar radiation.

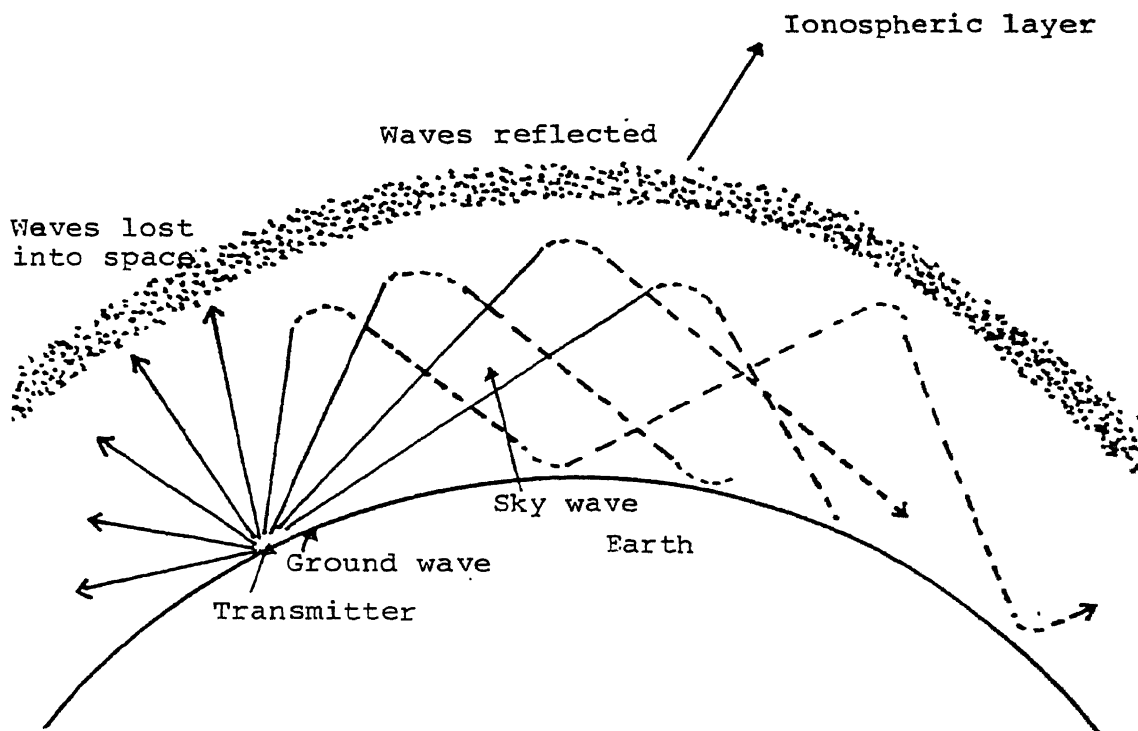


Fig. 1.6: Formation of Ions

Activity

Students should be asked to collect more information regarding 'ozone layer'.

1.5 Evaluation

1. List out the different layers in atmosphere and their extension.
2. Define global warming.
3. State the causes of ozone hole formation.
4. List out the names of gases which are mixedly found in air.
5. What is green house effect ?
6. Provide flash cards of various layers of atmosphere to the students in a mixed form and ask them to assemble in an order from lowest layer to highest layer.

Fill in the blanks

1. The envelope of air surrounding the earth surface is called _____.
2. The temperature in troposphere decreases as the altitude increase, this is known as _____ rate.
3. The glass roof works as a _____.
4. Clouds are almost absent in _____.
5. The ionosphere works as a _____ of radio waves.

TEMPERATURE AND PRESSURE

Introduction

There are many elements of climate namely temperature, pressure, humidity, winds, clouds and rainfall. It is essential to understand each of these element thoroughly in order to understand the climate of any place. Climate vary from place to place because of the variations in the climatic elements. We know that there are many factors responsible for variation in climatic elements which in turn affect the climate.

Temperature and pressure are very important among the climatic elements because they greatly affect the other elements of climate such as humidity, winds, etc. Temperature and pressure are also affected by many factors, hence we find variation in the distribution of temperature and pressure over the surface of the earth both by horizontally and vertically.

Instructional Objectives

1. To recall variations in climatic elements such as temperature, pressure, rainfall, etc. from the place to place.
2. To understand solar radiation.
3. To define the solar constant.
4. To understand the process of atmospheric heating.
5. To differentiate between conduction, convention, radiation and advection.

6. To see the kind of distribution of temperature over the surface of the earth.
7. To show the distributional pattern of isotherms over the globe.
8. To see the relationship between temperature and other factors like latitude, wind direction, oceans, altitude, etc.
9. To know the relationship between temperature and pressure.
10. To see the horizontal distribution of pressure over the earth surface.
11. To see the distribution pattern of isobar over the globe.
12. To identify various pressure and temperature belts over the earth.
13. To recognise the shifting of pressure belts and to account for it.
14. To understand the methods of measuring the temperature and pressure.
15. To understand the instruments used to measure temperature and pressure.
16. To understand the method of converting into fahrenheit and vice-versa.

Concepts

1. Sun is the main source of the atmospheric heat.
2. Atmosphere gets heated up through four process namely, conduction, convection, radiation and advection.
3. Solar constant varies from place to place owing to solar insolation which also varies from place to place.

4. Convection is main process of atmospheric heating.
5. Temperature is always high near the equator and decreases as one moves away from the equator.
6. Division of earth into three temperature belts namely, torrid, temperate, and fregid zones is based on latitudinal extension.
7. Isotherms are more parallel to equator in the southern hemisphere where we find the predominance of oceans.
8. There is inverse relationship between temperature and pressure.
9. There is also inverse relationship between altitude and temperature.
10. The regular pressure belt keep moving north and south of the equator with the migration of perpendicular rays of the sun.
11. Temperature is measured in terms of degree centigrade or degree of fahrenheit while pressure is measured in terms of millibars.
12. Thermometer is used to measure temperature while barometer is used to measure the pressure.

Development

Teachers are expected to list the factors which affect the climate and the elements of climate. Factors which affect climate are: 1. Latitude, 2. Altitude, 3. Distance from the sea/oceans, 4. Prevailing winds, 5. Ocean currents, 6. Topography, 7. Vegetation, and 8. Distance from the sun.

Elements of climate are: 1. Temperature, 2. Pressure, 3. Humidity, 4. Clouds, 5. Rainfall and 6. Winds.

Explain the students the relationship between factors which affect the climate and the elements of the climate through simple diagram/illustration as given below. (Fig. 1.7)

Climatic Controls of a Place

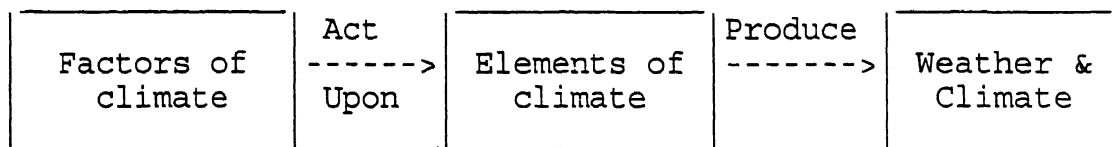


Fig. 7: Climatic Controls of a Place

Solar Insolation

Radiant energy of the sun received by the earth is solar insolation.

Solar Constant

It is estimated that on an average every minute the earth is receiving about two calories of heat (1.94 calories to be specific) per square centimetre. This fixed amount is known as solar constant. Solar constant differs from place to place depending upon many factors such as (1) inclination of the sun's rays, (2) duration of the sun shine. We have to explain the relationship between temperature and inclination of the sun's rays and it should be demonstrated to the students through the diagrams as follows. (Fig. 1.8)

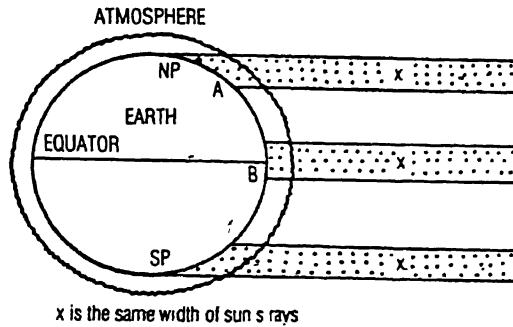


Fig. 1.8: Latitudinal Effect on Air Temperature

Vertical rays have to pass through a smaller portion of the atmosphere and spread over a smaller extend of the surface while slanting rays have to pass through a greater distance and spread over larger extend of the surface. Hence the areas which received perpendicular rays are warmer than the other areas. That is why equatorial regions are usually warmest.

Activity 1

With the help of a globe and a torch or candle one can demonstrate this.

Duration of the sun shine is another factor affecting the temperature of the place. If the duration of the sun shine is more, temperature also will be more. Duration of the sun shine is again related with the revolution of the earth around the sun and the inclination earth's axis.

Hence, the temperature differs from latitude to latitude and from the season to season. (Remind the students of the effects of the revolution of the earth).

Altitude also affect the temperature of a place. Lower layers of the atmosphere because of the closeness to the earth's surface are warmer than the upper layers. That is why temperature decreases with increasing height.

Heating of the Atmosphere

Conduction, convection, radiation and advection are the four process through which atmosphere gets heated up. Conduction is important among process of heating among solids and convection is important among fluids. Convection is the major process of heating the atmosphere since atmosphere is fluid.

Teachers may draw the attention of the students regarding the following: On a cloudy day we feel stultry because radiation is obstructed.

During summer places like Simla, Ooty, etc. will be having lower temperature because of their elevation (altitude). Hence they are summer resorting stations.

Temperature Zones of the Earth

Three zones, viz. Torrid, Temperate and Frizid zones need to be discussed here as given in the Kerala state text books (8, 9 and 10 standards).

Vertical Distribution of Temperature

Temperature decreases with increase in height at the rate of 3.3° Fahrnheit for every thousand feet (metre

conversion). This is what is known as "Normal Lapse Rate". However under certain conditions reverse process will happen, i.e. temperature increases with increasing height. This process is known as "Inversion of Temperature".

Pressure

Air has weight. Hence it exerts pressure.

Activity

To demonstrate that air has weight, one can use a balloon as follows. Weigh the balloon before and after air is filled and note the difference in weight. Observe that the balloon after air is filled will weigh more because of the presence of the air. It proves that air has weight.

Temperature Effects the Pressure

Higher the temperature lower is the pressure. This is because of high temperature air gets expanded and consequently less amount of air occupies larger area thereby reducing the pressure.

Pressure is more in the lower layer of the atmosphere because of the compression from the above. That is why lower layers are denser and heavier than the upper layers. Consequently pressure also decreases with increasing height.

Pressure Belts

Pressure belts of the globe has to be explained with the help of the diagrams given in the textbook.

High and low pressure belts on the globe are formed due to thermal and dynamic factors. Thermal is related to temperature and we know that temperature varies from place to place, hence cause variation in pressure also.

Dynamic factor should be explained with reference to rotation of the earth and deflection of the moving objects. A brief explanation for this is given below.

The air that rises at the equator flows towards the poles. While flowing, it gets deflected due to the rotation of the earth and by the time it reaches $30-35^{\circ}$ latitudes it gets deflected to maximum extent. It cannot proceed further, hence the air starts descending and it gets piled in these latitudes creating the subtropical high pressure belts in these areas.

Shifting of Pressure Belts

Need to be explained in the relation to movement of the sun's rays in different seasons of the earth. (Teacher has to draw attention of the students on the effect of the earth's revolution discussed in the earlier chapters).

Measurement of Temperature and Pressure

Temperature

Temperature is measured with thermometer. The heat is expressed in degrees on the centigrade or Fahrenheit scale. In Fahrenheit scale the boiling point of water is placed at 212° and freezing point 32° . While in centigrade scale the freezing is 0° and boiling point is 100° . That is why thermometer had a scale of $32^{\circ}\text{F}-212^{\circ}\text{F}$ and $0^{\circ}\text{C}-100^{\circ}\text{C}$.

Conversion of the Scale

Centigrade to Fahrnheit

$$F = (C \times 9/5) + 32$$

Example 10°C is to be converted into the °F

$$\begin{aligned} F &= (10 \times 9/5) + 32 \\ &= (90/5) + 32 \\ &= 18 + 32 \\ &= 50^{\circ} \end{aligned}$$

Fahrnheit to Centigrade

$$C = 5/9 (F-32)$$

Eg. 50°F is to be converted into Centigrade

$$\begin{aligned} C &= 5/9 (50-32) \\ &= 5/9 (18) \\ &= 5/9 \times 18 \\ &= 5 \times 2 \\ &= 10^{\circ} \end{aligned}$$

Pressure

Barometer is used to measure the pressure. Pressure is expressed usually in terms of millibars (mb). The sea level pressure is equal to 760 mm or 1013.2 mb or 76 centimeters (cm). That is why normally a column of mercury of 760 mm or 76 cm long is held in a closed glass tube. When pressure increases the level of column rises and vice versa.

Evaluation

I.

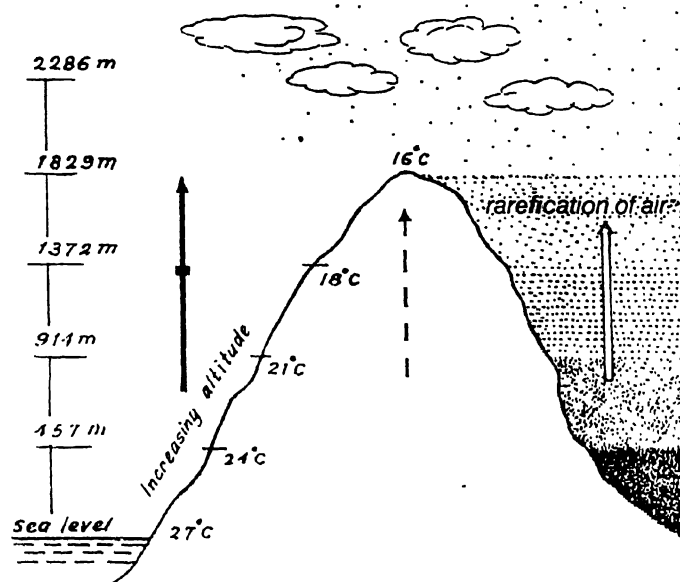
1. What is solar constant ? How does it vary from place to place ?
2. What is meant by solar insolation ?

3. Explain different ways of heating of the atmosphere ?
4. Explain with neat diagram why temperature is always higher near the equator.
5. Why isotherms are more parallel to the equator in the southern hemisphere ?
6. What is inversion of temperature ? When does it happen ?
7. What kind of relationship do you see between temperature and pressure ?
8. What is atmospheric pressure ?
9. With the help of neat diagram explain different pressure belt of the earth.
10. Why do pressure belts shift from season to season ?

Study the diagram given below and answer the questions that follow.

- a. Why does heat escape more rapidly at higher altitudes than at sea level ?
- b. What is the rate of decrease of temperature with altitude called ?
- c. What is the rate of decrease shown on the diagram ?
- d. What is the approximate height of the hill ? .
- e. What is the temperature inversion ?

Study the diagram given below and answer the questions

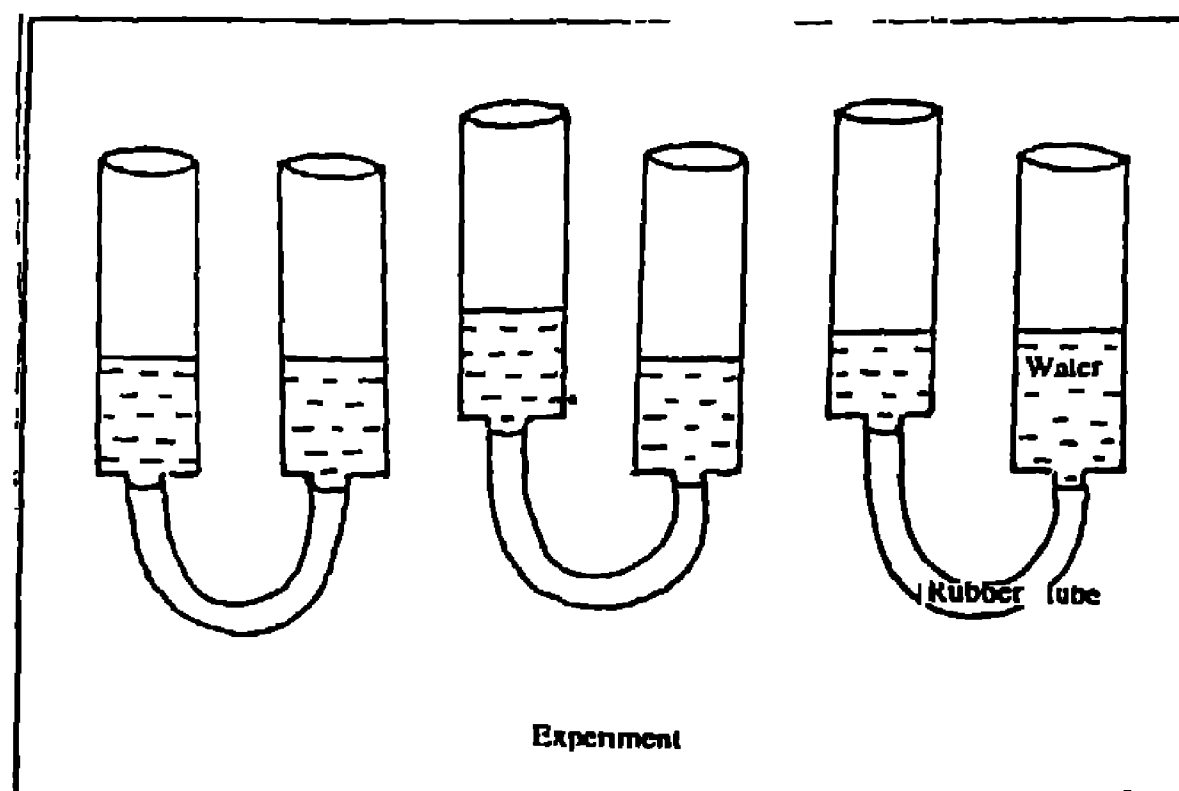


II. Multiple Choice

1. Isotherm is
 - a. a line joining the places of equal pressure
 - b. a line joining the places of equal temperature
 - c. a line joining the places of equal rainfall
 - d. a line joining the places of equal humidity
2. Pressure is measured by
 - a. thermometer
 - b. raingauge
 - c. barometer
 - d. wind vane
3. Fill in the blanks
 - a. Thermometer is used to measure _____.
 - b. Increase in temperature leads to _____ in pressure.
 - c. The lines used to show the horizontal distribution of pressure are _____.

Other Activities

- 1 Give the students some data on temperature and pressure for a hypothetical region and ask them to draw isobars and isotherms
- 2 Ask students to maintain record of daily maximum and minimum temperature for their metropolitan centre for a few months. Ask them to prepare graph showing maximum and minimum temperature
- 3 Give the students some exercises on conversion of $^{\circ}\text{C}$ to $^{\circ}\text{F}$ and vice-versa
- 4 Take students to nearby weather station and explain different instruments
- 5 Prepare model as shown in the following diagram



Water flows from high places to lower places. Likewise, wind also blows from high pressure area to low pressure area. The velocity of the wind depends upon the pressure gradient. This can be explained through the above said example.

Teaching Aids

- a Globe
- b Candle/torch
- c World map
- d Weather chart

WIND SYSTEM

Introduction

Wind is also an important element of climate. We know that temperature and pressure cause air movement. In addition to these, rotation of the earth and gravitational force are other factors which are responsible for large scale and regular motion of the air in the atmosphere. Hence it is important to understand the kind of atmospheric movement, its causes and consequences.

Instructional Objectives

1. To understand the causes for atmospheric circulation.
2. To distinguish between winds and air currents.
3. To understand the impact of rotation of earth on the direction of wind movement.
4. To identify different kinds of wind system over the earth.
5. To discriminate between different kinds of planetary winds.
6. To understand the causes for land and sea breeze.
7. To study the mechanism which leads to occurrence of monsoon winds.
8. To discriminate between the tropical and temperate cyclones.
9. To identify the various local winds in different parts of the world.

Concepts

- 1 Temperature and pressure are major factors causing atmospheric circulation
2. Movement of air would be either horizontal or vertical
- 3 Horizontal movement of the air is wind and vertical movement is current.
- 4 Due to the rotation of the earth coriolis force is created
- 5 Coriolis force is responsible for the deflection of the winds.
- 6 Winds could be regular, periodic or variable
- 7 Regular winds are also called as prevailing winds which do not change their direction
- 8 Periodic winds change their direction from the season to season
- 9 Irregularities produced by local conditions in the atmosphere cause variable winds
- 10 Local winds are called by different names in different parts of the world

Development

We have noted that air movement or circulation in the atmosphere takes place because of many factors like variation in the temperature, pressure, rotation of the earth, etc

| Differences in temperature leads to variation in pressure from place to place This difference in pressure causes air to move horizontally over the surface which we

call the wind. Wind always blows from high pressure to low pressure area. The speed of the wind depends on pressure gradient. Pressure gradient is the rate of change of pressure for unit horizontal distance. It is also called barometric slope. The nature of the gradient determines the velocity of the wind. If the pressure gradient is steep then the velocity of the wind also be high and vice-versa as shown in the figures given below

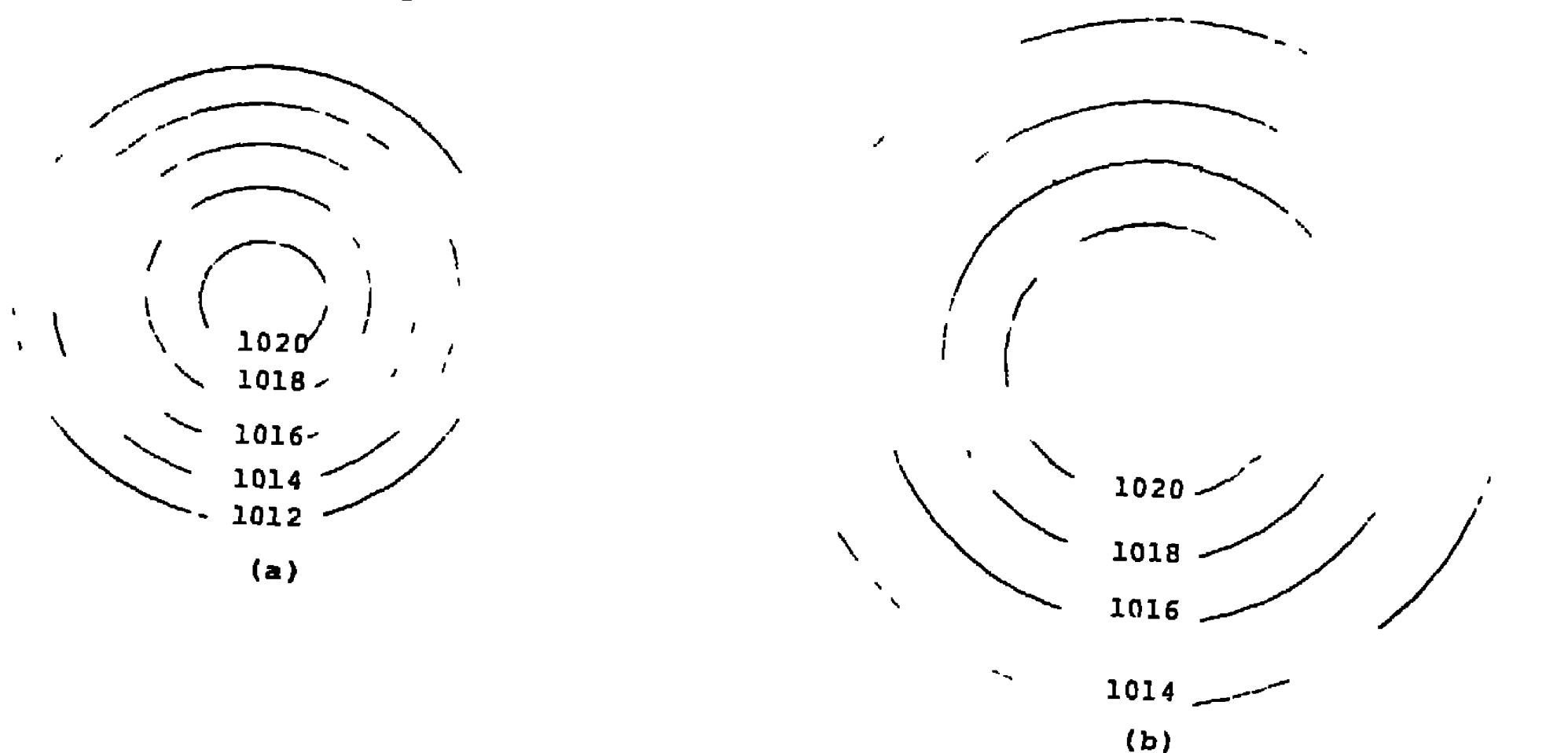


Fig. 1.9 (a) and (b) : Steep and Gentle Gradient

In figure A, the isobars are spaced closely and rate of change in pressure is high within short distance. That is why the gradient (slope) is steep and the velocity of the wind is high. On the other hand in figure B, the isobars are spaced far apart and the gradient is gentler. As a result the velocity of the wind is low.

To understand the above point clearly one can recall the spacing of contours and the resulting nature of the slope. The same principle holds good in the case of pressure gradient also.

Another force which affects the direction of wind movement is rotation of the earth. This force was discovered by G. G. Coriolis. Hence this force was named after him. The Coriolis force causes deflection in the direction of the wind. Winds tend to deflect towards their right in the northern hemisphere and towards left in the southern hemisphere because of the Coriolis force. This law was established by an American scientist by name Ferrel. Hence it is known as Ferrel's law.

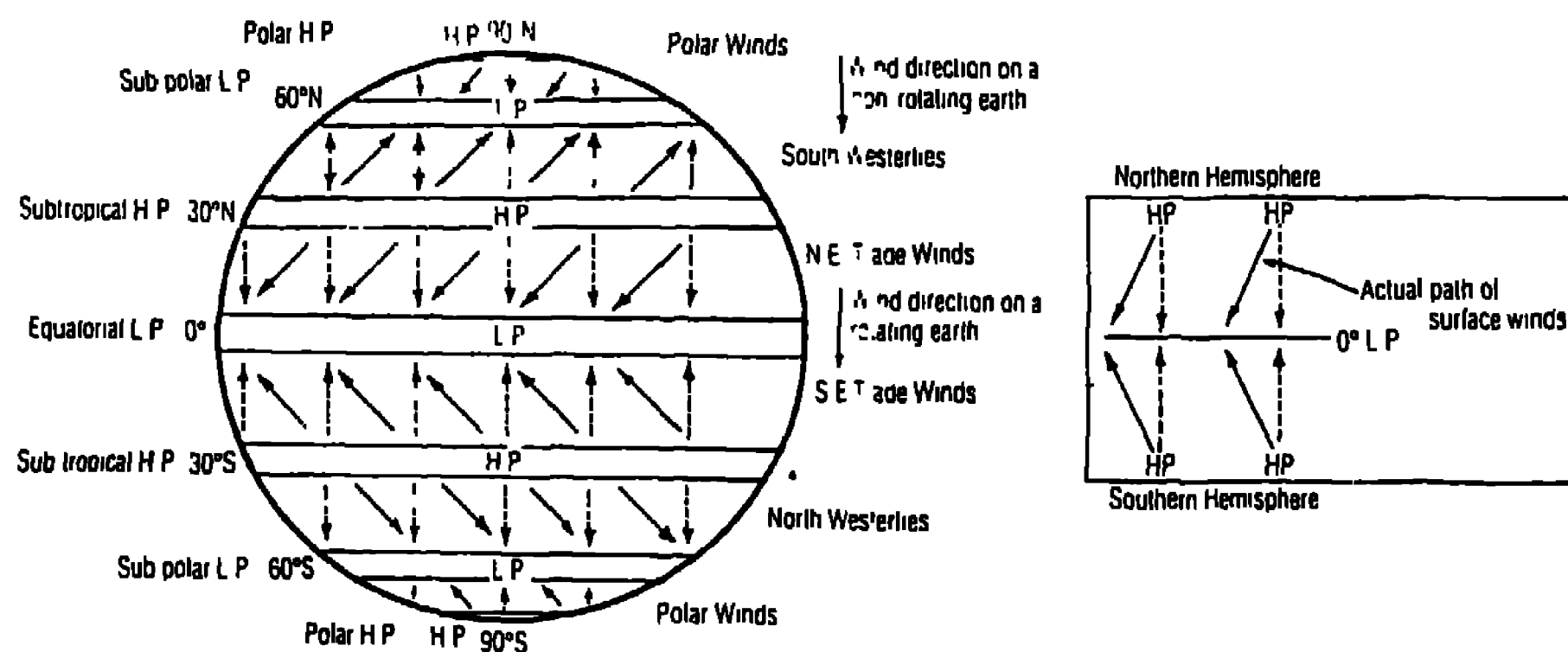


Fig. 1.10: Ferrel's Law

Types of Wind

Winds are classified into various types according to their characteristics, duration and direction of movement. Normally we can divide winds into four main types. They are

- 1 Prevailing or planetary winds
- 2 Seasonal or periodic winds
- 3 Local winds
- 4 Variable winds

Planetary wind system is to be discussed here as given in the textbook

Hadley Cell Thermally related air circulation take place in the tropical belt which was explained by G Hadely in 1735 Hence this cell is named after him

Ferrel Cell In mid-latitude region the winds blow from west-east because of Coriolis force This was explained by an American scientist, Ferrel So this cell is named after him

Polar Front Cell It refers to the air circulation in the polar regions

Seasonal and periodic winds These are the winds which change the direction from season to season Eg Monsoons

Monsoon winds to be discussed here

Local Winds These winds develop in those regions where daily change of temperature and pressure is very prominent Eg 1 Land and sea breezes, 2 Mountain and valley breezes, 3 Warm and dry winds like Foehn, Chincok, Loo, etc

These have to be discussed with the diagrams

Variable winds These winds are violent and irregular They occur because of the great irregularities in temperature and pressure in some areas. Eg Cyclones, anti-cyclones, tornado and hurricane

These need to be discussed here as given in the textbook.

Evaluation

- 1 Distinguish between wind and air current.
- 2 What are the causes of atmospheric circulations ?
- 3 What is pressure gradient ?
- 4 What is Coriolis force ?
- 5 What does the Ferrel's law say ?
- 6 How are winds classified ?
- 7 What are the different type of winds ?
- 8 What are planetary winds ? Mention different types of planetary winds
- 9 What are trade winds ?
- 10 What are westerlies and easterlies ?
- 11 Draw a self-explanatory diagram of planetary wind system
- 12 Explain sea and land breezes with the help of diagrams
- 13 What are mountain and valley breezes ? Explain with diagrams
- 14 Distinguish between tropical and temperate cyclones
- 15 Why are Chinook winds dry and warm ?
- 16 Why is tropical cell named Hadley cell ?
- 17 What is Ferrel's cell ?

Multiple Choice

- 1 Land breezes blow from
 - a sea to land
 - b land to sea
 - c mountain to valley
 - d valley to mountain

2. Wind blows due to
 - a. forest and agricultural crops
 - b. land and sea distribution
 - c. difference in pressure
 - d. evolution of the earth

Fill in the Blanks

- 1 Trade winds blow from sub-tropical high pressure belt to _____
- 2 The term cyclone is derived from Greek word _____
- 3 The plane along which the two air masses meet is called _____
- 4 Anti-cyclones move in a clockwise direction in _____ hemisphere and in a counter clockwise direction in _____ hemisphere

Other Activities

- 1 Ask students to draw world map and mark the places where tropical and temperate cyclones normally take place
- 2 Students may be asked to collect information on the major cyclones occurred in East Coast of India, year of occurrence, death toll, etc
3. Students may be asked to draw the diagrams of cyclones and anti-cyclones in northern and southern hemisphere and mark the direction of wind movement
4. Students may be asked to identify the winds in India which are similar to Chinook winds
5. Make a list of weather elements and instruments used to measure them.

Teaching Aids

1. World map
- 2 Globe

WATER IN THE ATMOSPHERE

Introduction

Moisture is continually entering and leaving the atmosphere as part of the earth's hydrological cycle. The air gains water vapour mainly by evaporation from the earth's water surfaces, and also by transpiration from plants. These two processes together are sometimes referred to as evapo-transpiration. In return process, water is precipitated from the atmosphere mainly in the form of rain or snow. This never-ending cycle entails energy exchanges of considerable magnitude, and we shall see that many of the climatic processes involving moisture also inevitably involve temperature changes.

Variations in the atmospheric moisture content depend on a number of factors, but probably the most important control is that of temperature. This is because temperature fundamentally affects the moisture-holding capacity, or saturation limit of the air. Cold air can hold very little moisture, and consequently the water vapour content is always low in absolute terms when the air temperature is low. As the temperature increases, the moisture-holding capacity also increases.

Water is present in the atmosphere in all the three forms (gaseous-water vapour, liquid-water droplets and solid-ice crystals). Significance of water listed as

1. The amount of water vapour present in a given volume of air indicates the atmosphere's potential capacity for precipitation.

- 2 Water vapour absorbs radiation and therefore, it is a regulator of heat loss from the earth
- 3 The amount of water vapour present, in the atmosphere affects the human body's rate of cooling

Instructional Objectives

- 1 To recognise the presence of water in the atmosphere
- 2 To recognise from where the water entered the atmosphere
3. To recognise the form of water in the atmosphere
- 4 To understand the relationship between temperature and water content in the air
- 5 To interpret evaporation
- 6 To interpret what is humidity
- 7 To understand the relative humidity
- 8 To recognise condensation process
- 9 To discriminate the forms of condensation
- 10 To recognise Dew and Hoar Frost.
- 11 To recognise mist and fog
- 12 To classify clouds according to its nature
- 13 To understand precipitation process
- 14 To recognise the types of precipitation
 - (i) Orographic, (ii) Convectional, (iii) Cyclonic or Frontal
- 15 To recognise the border rain
- 16 To understand the method of measuring rainfall
- 17 To recognise various rainfall regions of the world
- 18 To understand the effectiveness of rainfall
- 19 To recognise the water cycle

Concepts

- 1 Water in the form of vapour is present in the atmospheric air
- 2 All the water bodies and vegetation are the chief suppliers of water vapour
- 3 Water is present in the atmosphere in the form of solid, liquid and gas
- 4 Evaporation is the change of water in liquid form into vapour by heat energy
- 5 Evaporation is high when the temperature is high
- 6 Invisible water vapour present in the atmosphere is known as humidity
- 7 Relative humidity is the ratio of water vapour capacity at a given temperature
- 8 Condensation is the process of change of state from gaseous to liquid or solid state
- 9 Dew and Hoar Frost, Mist and Fog are the different forms of condensation.
- 10 Clouds are classified into (i) Cirrus cloud, (ii) Stratus, (iii) Cumulus and (iv) Nimbus according to their shape
- 11 Precipitation results when continuous condensation takes place rapidly within the clouds.
12. Snow, hail stone, rainfall are the forms of precipitation.
- 13 Orographic precipitation occurs when humid air strikes land form barrier.
14. Convectional rainfall occurs when humid air is absent at great heights

- 15 Cyclonic or frontal rainfall occurs when cyclone pushes the warm air upwards.
- 16 Border rain caused by warm air mass from sea, passing over a cold land in winter
- 17 Rainfall is measured by rain gauge
- 18 World can be classified according to the amount of rainfall in a year
- 19 Heavy rain in short period leads to wastage
- 20 Evapotranspiration and precipitation cause water cycle

Developments

When we go for a walk early in the morning we find dew drops shining on grass-leaves and flowers. Where does this water content come from? How is it formed? Water exists in the atmosphere in all three states - solid, liquid and gas. But most commonly water exists as a tasteless, odourless, transparent gas known as water vapour.

Activity 1

Take a glass tumbler or an earthenware tumbler. Put some ice cubes in it. Wait for five minutes, now look at the outer surface of the tumbler. There will be small drops all over the surface. This is because the water present in the atmosphere in vapour form which we cannot see, is condensed or shrinks into water drops when it touches the cold surface of the outer surface of the tumbler. So the water formed and remains on the outer surface.

Water vapour in the atmosphere comes through evaporation from the oceans, lakes, rivers, ice fields and

glaciers, which together comprise about 75 per cent of earth surface. Besides these source evaporation from the moist ground, transpiration from plants and animals respiration also contribute moisture to the atmosphere

Water exists in all three states of matter in the atmosphere as water vapour in gas form, in liquid state as water, and in solid state as ice. Changing one to other are frequent occurrences in the atmosphere and are known as phase changes (Fig 1.11). A certain amount of energy is used in accomplishing phase changes. Prepare a chart shown in the figure and explain it in detail.

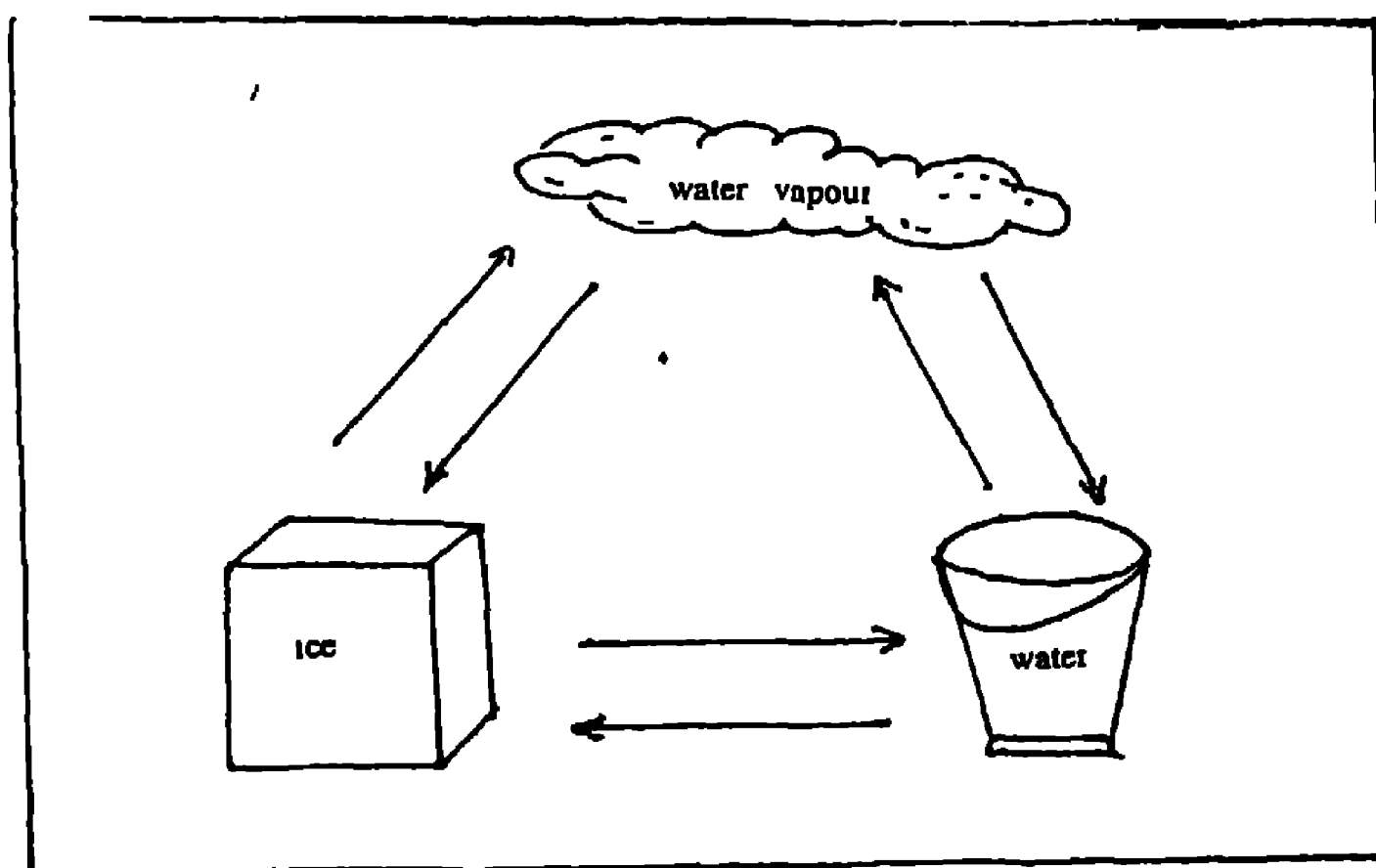


Fig. 1.11: Phasewise Changes of Water

Evaporation

What is evaporation? Recall the steam when cooking or boiling water.

You know evaporation is the change of liquid water into water vapour. In all the water bodies, plants, animals

and moisture places, the evaporation occur. Every second the thirsty atmosphere drinks 16 million tonnes of moisture from the surface of the earth. Temperature is the cause for the evaporation.

What are the factors that influence the rate of evaporation ?

The rate of evaporation depends on the amount of accessible water. So rate of evaporation is greater over the ocean than over the continents. Temperature also affects the state of evaporation. Evaporation is high when temperature is high. Dry air also affects evaporation. Drier the air, the greater is the rate of evaporation. We can visualise this through a graph (Fig 1.12)

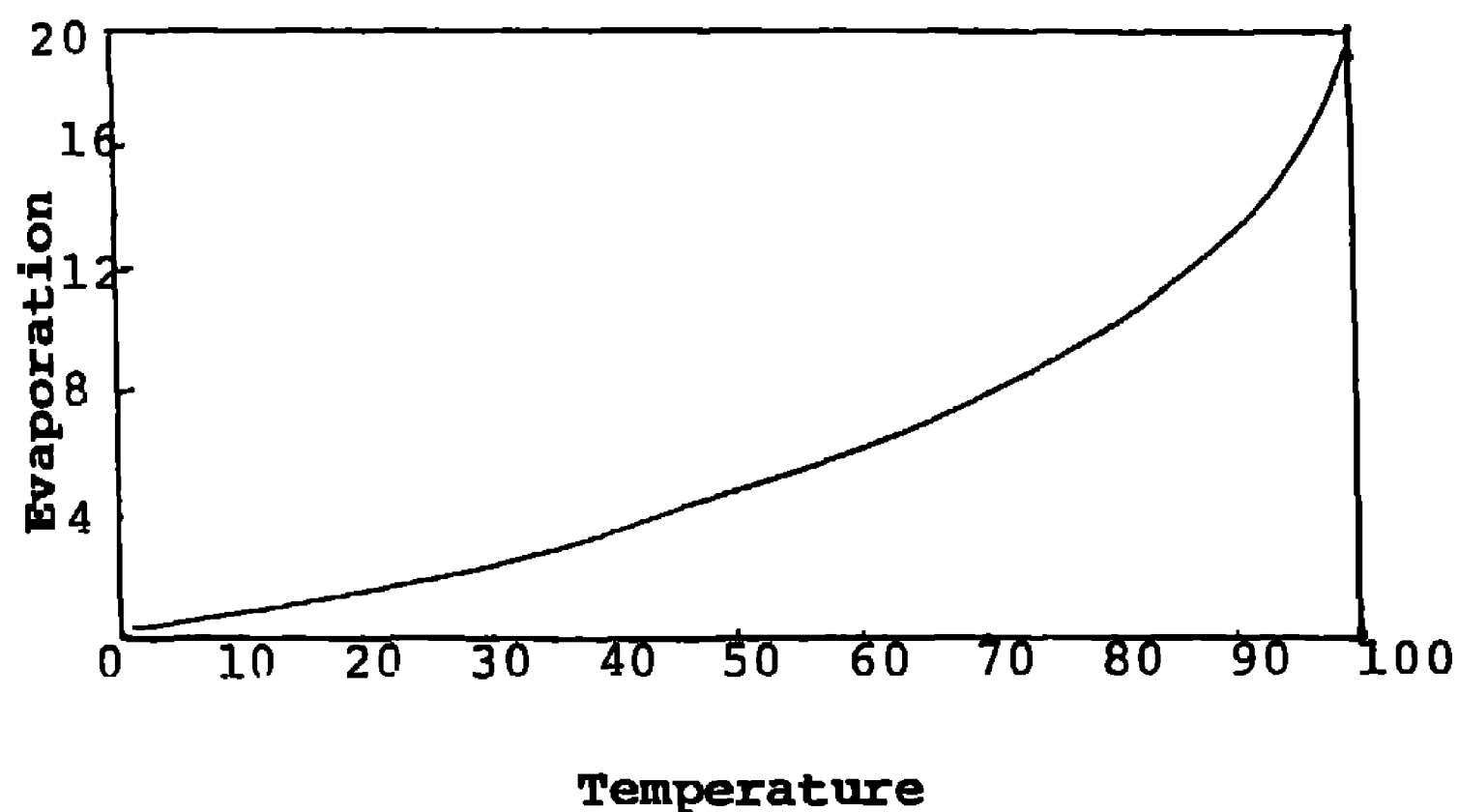


Fig. 1.12: Relationship Between Temperature and Evaporation

Activity

We can explain this through an activity, keep a vessel with full of water on a gas stove. Heat the water continuously for some time. Now students can be asked to

observe how the water is being changed into water vapour and how it gets into the atmosphere

What is saturation point in the air ?

Activity

Take a glass of water and put some salt in that water and stir it well, till the salt disappear in the water. Again put some salt and stir. Repeat it when the salt remains undissolved and visible to see. This point is known as saturation of salt in the water. Like this air also got saturation point which is any specified temperature there is a definite limit to the quantity of moisture that can be held by the air.

Take up the salt water glass and heat it for some time, and stir it now the remaining salt dissolves and you can put some more salt which also will dissolve. Stop heating and add more salt, it won't dissolve. This shows that the quantity of salt which can be dissolved in water is more in higher temperature of water. Like this air also takes the water vapour if the temperature increases.

Humidity

Humidity is the general term which describes the invisible amount of water-vapour present in the air. It may be expressed quantitatively in different ways. The weight of actual amount of water vapour present in a unit volume of air is called the 'absolute humidity'.

'Relative humidity' term defines the ratio of actual amount of water vapour in a unit of air, to the maximum

amount the air could hold at that temperature expressed as a percentage, i.e

$$\text{Relative humidity (RH)} = \frac{\text{Actual amount}}{\text{Possible amount}} \times 100\%$$

Thus air which is completely saturated has a relative humidity of 100 per cent.

Draw the following figures in a chart and make the students to observe this figure and explain temperature (Fig 1 13)

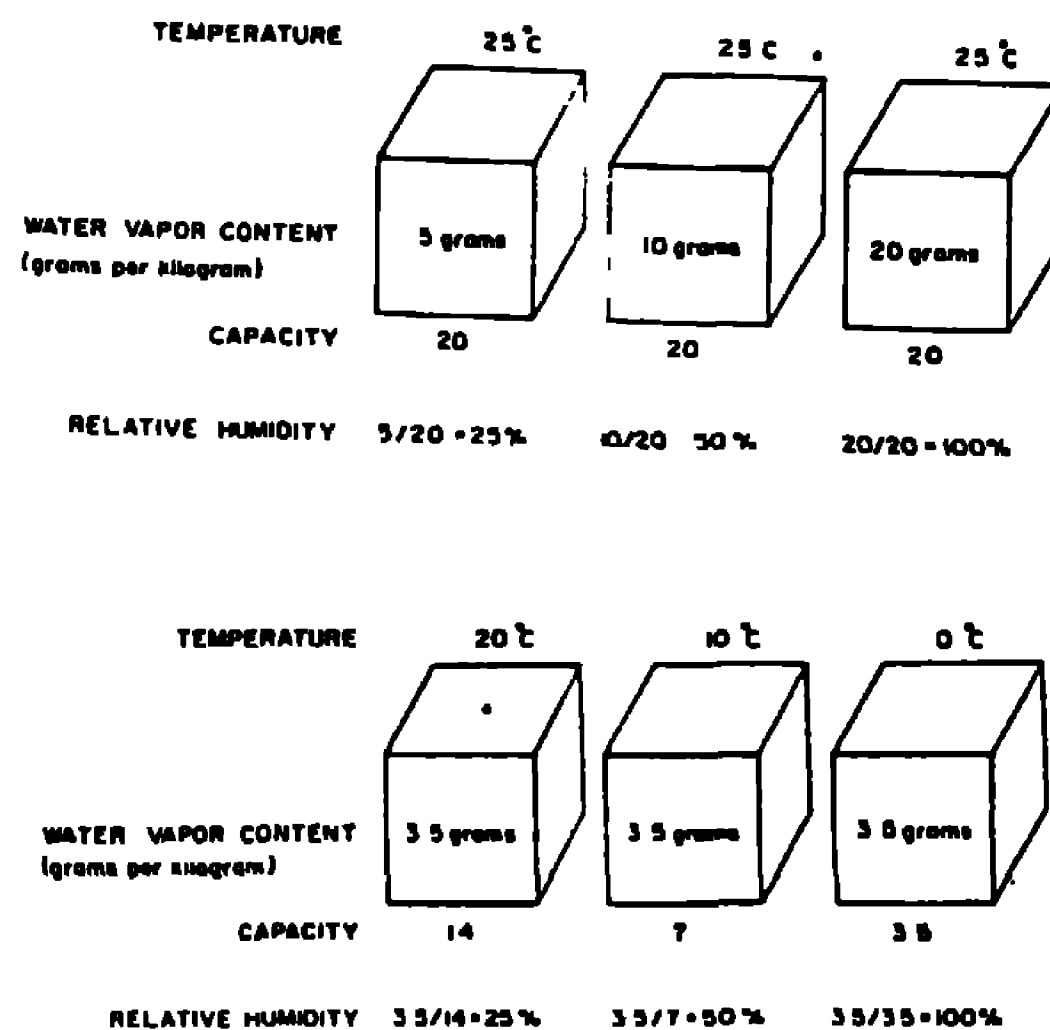


Fig. 1.13: Relative Humidity

Condensation

Recall the example of ice cubes, if we put water in cube tray of a fridge in the freezer section, within 20 minutes the water will become ice cubes. How ? Because of cooling

Teacher can make the students observe this activity Take wax, heat it and made it liquid wax and pour the

liquid wax to a small box Wait for some time After some time liquid wax become solid wax

Take away upper lid of boiling water vessel and hold it in separate place within some seconds there will water drops from the lid Where did the water come from ? The water vapour from boiling vessels gets cooled down to form water

The change of water vapour into droplets of water or crystals of ice is known as condensation Condensation occurs when the saturated air with water vapour is cooled We can say that if we lower the temperature of air until it has a relative humidity of 100 per cent condensation will occur with any further cooling

How does condensation take place ?

On a cold day blow out air from the mouth on a mirror It will immediately become cloudy Why does it become cloudy ? This is because water vapour from warm breath is condensed as little drops of water on the cold surface

These are minute particles of dust or salt in the atmosphere, around which condensation takes place. These are aerosoles

Effectiveness of condensation depends on three factors (i) cooling of air masses or fall of temperature, (ii) high humidity, (iii) presence of plenty of dust particles.

Dew and Hoar Frost

What is dew ?

Ask the students observe Teacher must fill a shiny-metal can about 2/3rd of water Add an ice cube and stir gently with a thermometer Place the can on a table and add ice cubes one after another and stir until drops of liquid begin to form on the sides of the can Read the temperature of the liquid in the can This is the dew point

Dew and Hoar frost are formed by the air mass condensing on a cold surface or object

You have studied that the land absorbs heat during the day and night Land becomes very cold, result is the cooled air deposits its moisture on the surface of objects, which come into contact with it This deposit of water is called dew In some places night temperature will go below 0°C In such place Hoar frost will form

Can you explain why dew is sticking more on metal objects than non-metal objects ? Observe the phenomenon on a cold morning outside your home

Mist and Fog

When the water is condensed but remains suspended in the air near the surface of the earth is called mist or fog Mist is exactly like a cloud near the ground In fog the particles of water are smaller than in a mist On the basis of observation teacher must discuss

- 1 Why are mists common over mountains ?
- 2 You can see mist over the water bodies in the evening In mornings they disappear Can you explain this ?

Clouds

Teacher should ask the students to observe the clouds in the sky, and make them to draw the shape and colour of cloud. And ask them how the clouds are formed ?

When the warm air rises up it expands and becomes cooler. Its temperature reaches below the dew point. The water vapour condenses as small droplets of water or tiny crystals of ice on dust particles. These droplets are so minute in the size of 0.02 to 0.06 mm diameter.

Types of Clouds

1. Cirrus clouds. These clouds are thin wispy white feather like clouds. They are observed high up in the sky.
2. Stratus clouds. The basic characteristic of stratus clouds is their horizontal sheet like appearance. They lie in layers.
3. Cumulus clouds. They develop vertically in the form of rising mounds. They look like cauliflower floating in the sky. The sunlit portion of these clouds are brilliant white.
4. Nimbus clouds. These are thick dark grey or black clouds that are found at very low height. Sometimes they even touch the ground. These are real rain clouds.

Precipitation

Find out the forms of precipitation.

1. Snow (ice form solid state)
2. Hail and hail stone (solid ice)
3. Rainfall - liquid

Ask the students recall the example of water and ice cubes. Like this precipitation results when continuous condensation due to cooling takes place rapidly. Within the cloud, water droplets grow in size due to this and cannot remain suspended in the air. So rainfall occurs.

Precipitation may be in the form of snow, hail and rain.

Snow

Show the pictures of snow covered mountain and photographs of region. Snow is the form of precipitation which takes place under very low temperature in higher altitudes. If condensation takes place below 0°C moisture released may be in the form of crystals. These crystals often join and form flakes of snow. Discuss where we can see the snow?

Hail and Hail stones

Ask the students whether they have ever experienced ice stone rain? Ask them how it occurs?

This can be explained that hail forms when rain drops are lifted to a colder layer of air where they freeze. When they fall through the cloud additional water drops added also get frozen and become big ice stones.

Rainfall

All students know this form of precipitation and recall the experience of rain. Ask them how rainfall occurs?

Rain occurs when cloud droplets in large numbers join and become too large to remain suspended in the air. It has

been estimated that one rain drop is formed by joining of one million water droplets. When they grow in size the resistance of air fail to support them and fall down as rain drops.

What are the different types of rainfall ?

According to the mode of occurrence, rainfall is divided into three types (1) Orographic rainfall, (2) Convectional rainfall, (3) Cyclonic rainfall or Frontal rainfall.

Orographic or relief rain (Fig 1.14)

Orographic precipitation

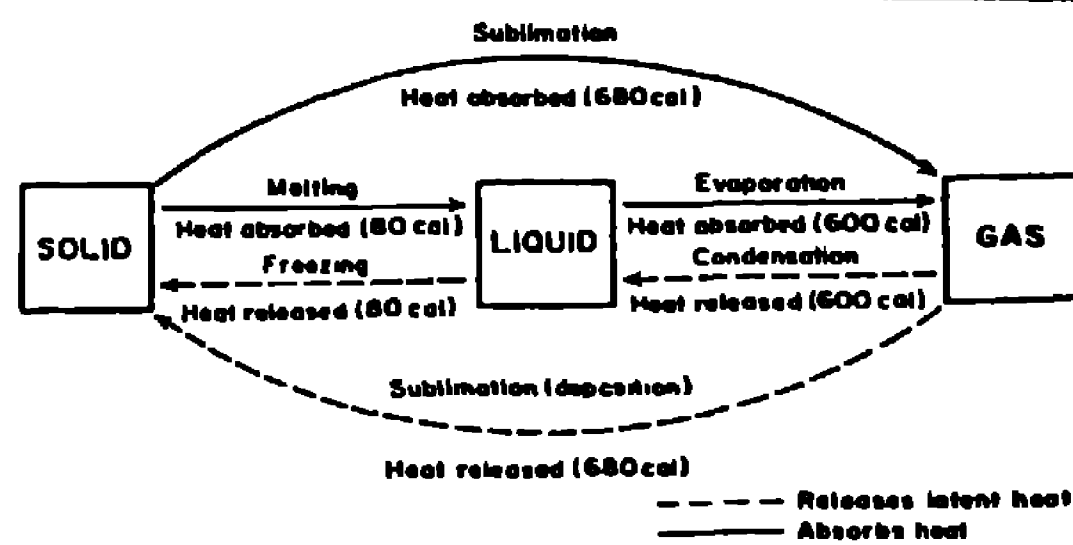
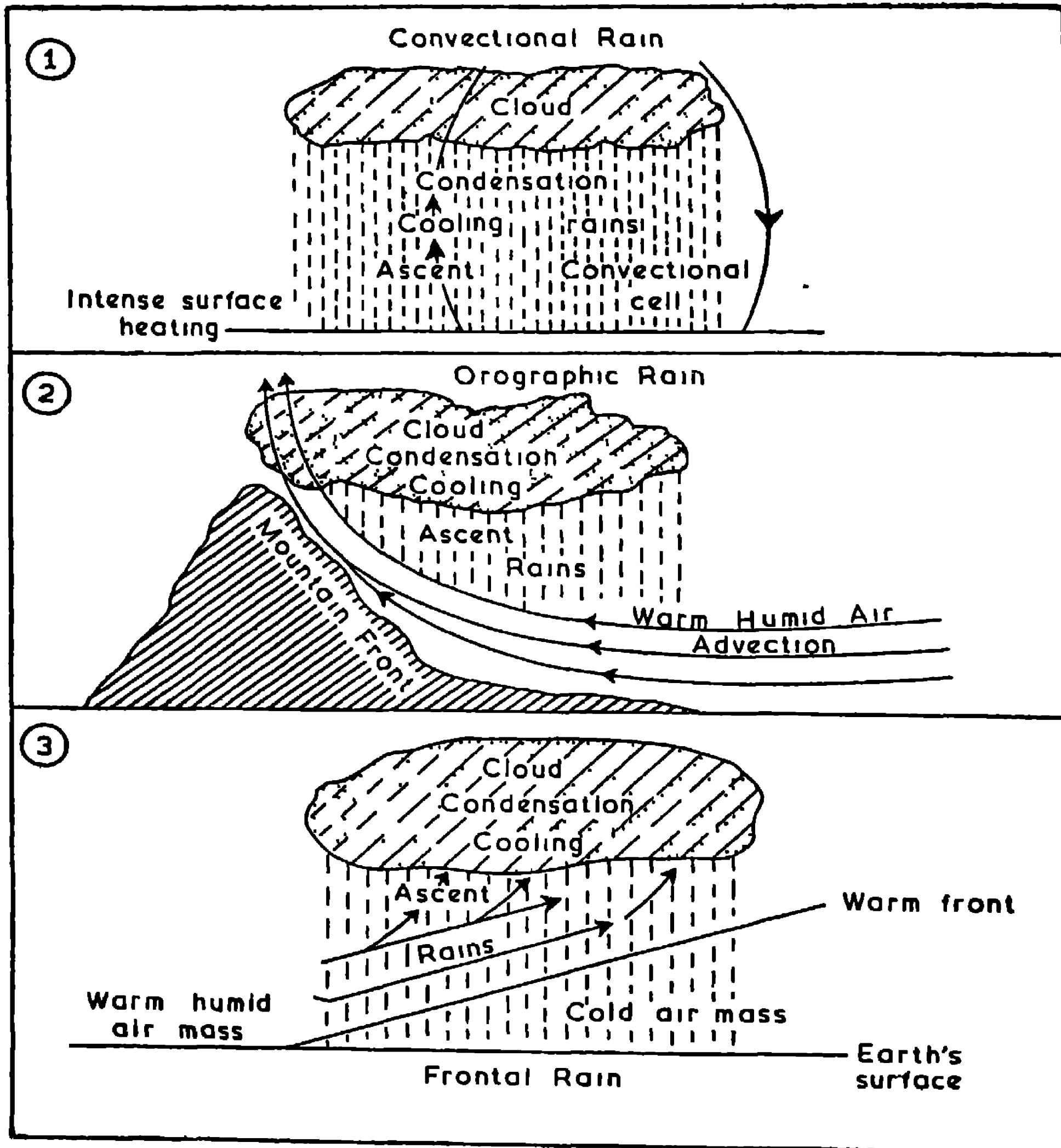
With the help of a chart or a diagram drawn on a blackboard the teacher can explain the ways in which orographic rainfall occurs. When the horizontally moving air mass is obstructed by the mountain the air mass tends to go upward. While going upward, due to the decrease in temperature it gets condensed and precipitates.

Convectional rainfall

The land surface is heated directly by the rays of the Sun. The air which is in contact with the warm surface becomes heated, expands and becomes lighter and therefore tends to rise. The air cools as it rises, water vapour condenses and clouds form. Further decrease in the temperature leads to rainfall. (Fig. 1.15)

Cyclonic or Frontal rainfall (Fig 1.16)

With the help of a diagram we can explain the frontal lifting. Discuss the nature of cold air, warm air and what



Changes of state

happens when they meet each other. Discuss the pressure system and nature of low pressure and cyclone

Warm moist air usually comes into contact with cooler drier air during the passage of a depression. The warm and moist air rises when it meets the cold, dry air, in doing so the warm air is cooled and causes rainfall when the cooling is below the dew point

Border Rain

Recall land and sea breezes, explain how it works. Explain border rain is caused by a warm air mass from the sea, passing over a cold land in winter. Air mass cools and then condensation takes place. It is limited to coastal areas.

How is rainfall measured ?

With the help of a picture of a rain gauge the teacher can explain the procedure of measuring the rainfall.

By using a bottle, graph sheets, funnel the teacher can make a rain gauge and explain it should be kept in an open place (not near the buildings, under the trees, etc.)

Distribution of rainfall

Ask the students to collect the information regarding the rainfall for last five years in their town or any other places. Ask them to prepare a graph for every year separately. Let them observe the seasonal changes in the graph.

Prepare a world map for distribution of rainfall with latitudes and longitudes. Make the students analyse why some areas receive heavy rainfall (eg) equatorial, why some areas receive very low rainfall or not (eg) desert or not teacher must explain the reason for it

Water cycle

Draw a chart to show the water cycle

Explain the cyclic process of water to the students

Evaluation

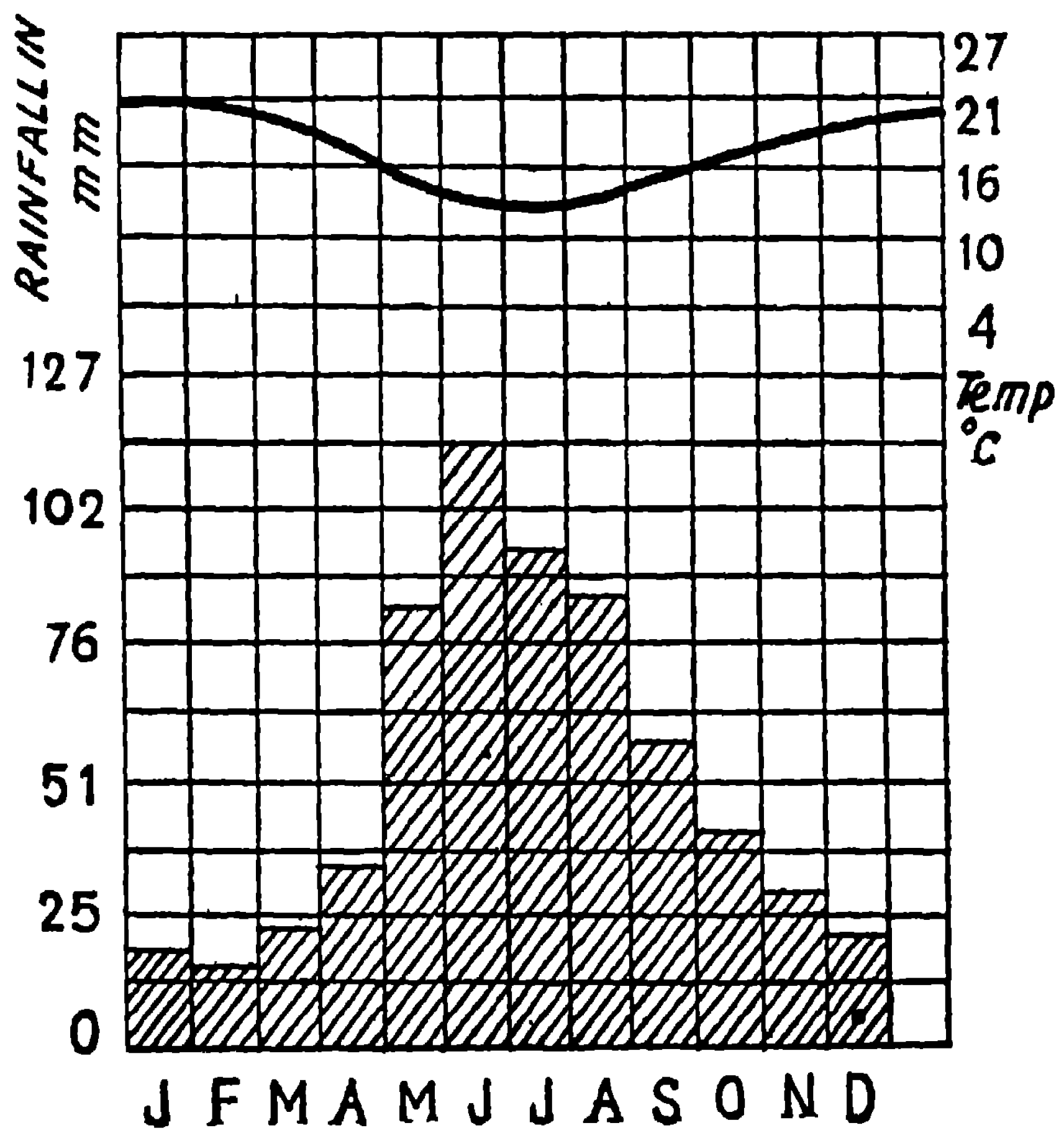
- 1 Distinguish between
 - (a) Relative humidity and absolute humidity
 - (b) Evaporation and condensation
 - (c) Humidity and rainfall
 - (d) Dew point and saturation
- 2 Draw the different cloud types and describe the nature of each cloud.
- 3 What is rainfall ? Differentiate it as per their mode of occurrence with pictorial representation
- 4 How does condensation take place ?

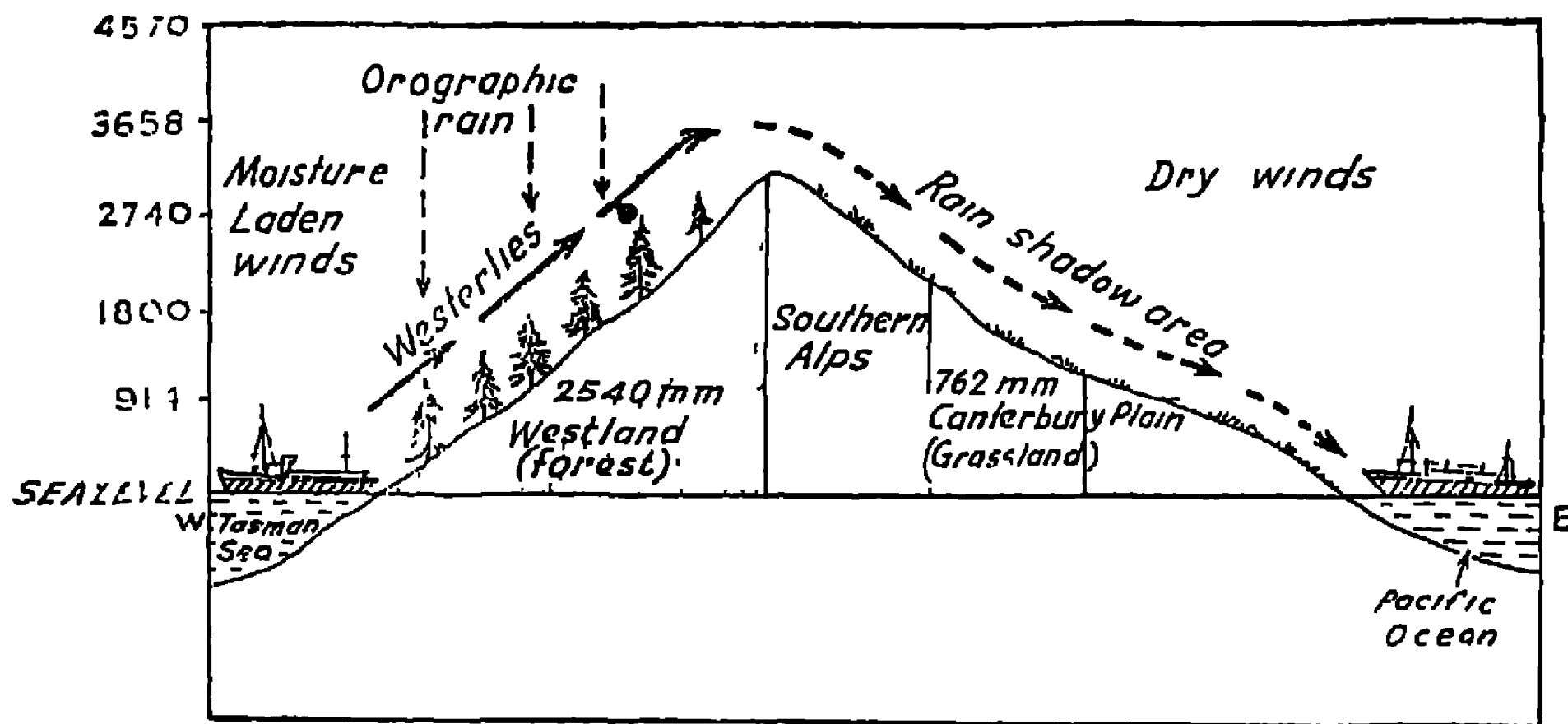
Activity

- 1 Prepare a raingauge
- 2 Draw chart for maximum and minimum temperature for a month, collecting information from newspaper
- 3 Study the temperature graph and answer the questions that follow
 - a Which are the coolest months ?
 - b. Which is the month with the highest mean temperature ?
 - c Name the month with the highest rainfall
 - d What is the annual range of temperature ?
 - e The altitude of the town is 12 m Find the sea-level equivalent of its temperature in January
 - f In which hemisphere does the town lie ?
 - g Give one reason.

-52a-

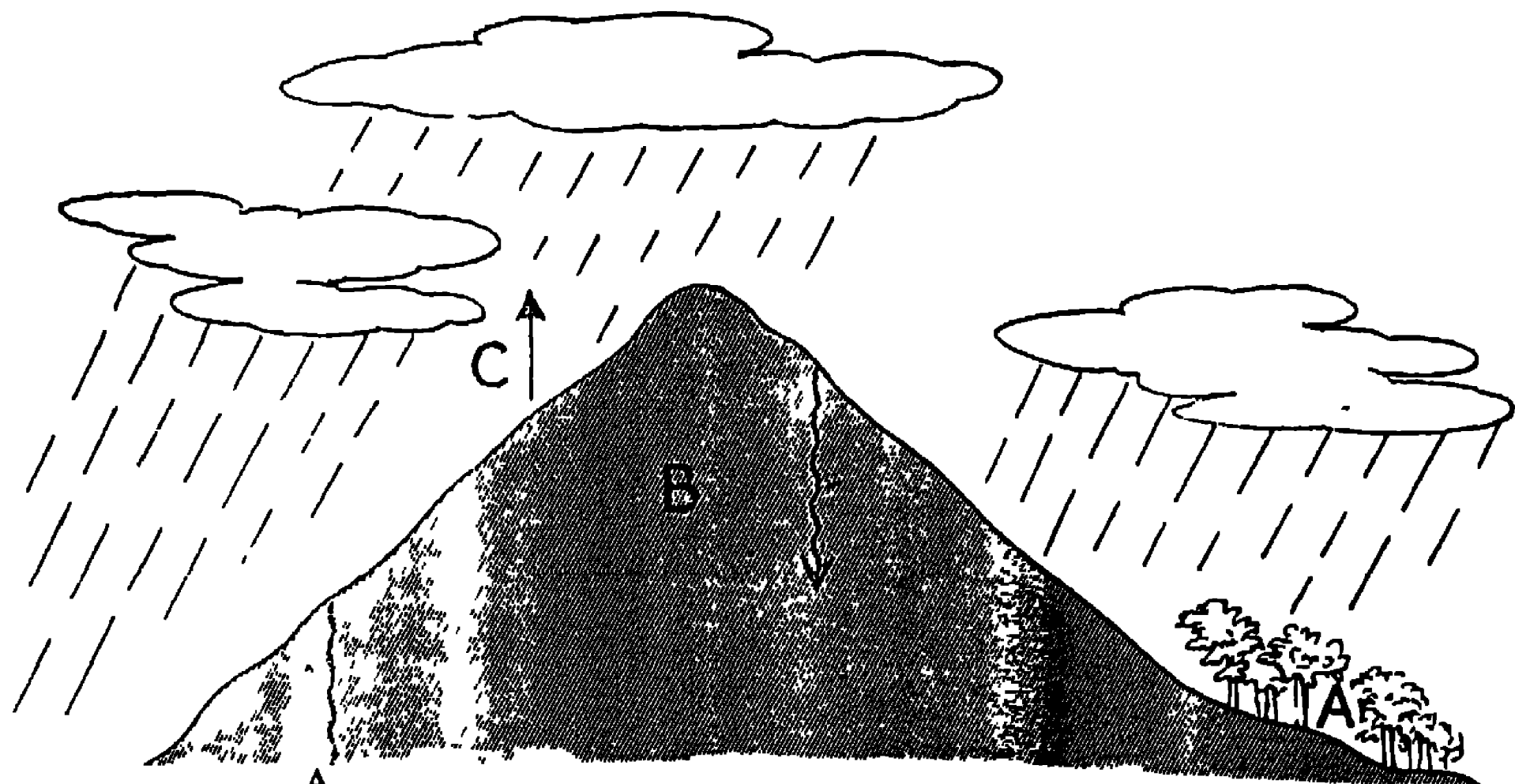
Study the temperature graph given below





What is a rain shadow area?

- 1a) The figure given shows below three ways (A,B,C.) in which water disappears after heavy rain
Describe each way



A ...
B. ..
C

(b) What type of rainfall does the figure depict?

(c) Briefly describe how this rainfall is caused

LITHOSPHERE

LITHOSPHERE

Introduction

The earth's surface is undergoing constant changes due to the forces operating both inside and outside of the earth crust. Areas above the sea level may go down suddenly and like wise some areas may be raised, these activities are called as submergence and emergence respectively.

Most of the land features like mountains and plateaus are the result of the movements of the earth crust called Tectonic movements (internal forces). Certain sudden movements and slow or secular movements are taking place on the earth's crust. All the above said forces are called internal forces.

On the surface of the earth there are forces operating constantly carrying on erosional (degradation) and depositional (aggradation) work. These forces are called external forces which includes river, underground water, glaciers, wind and waves. These external forces are eroding, transporting and depositing the materials lying on their course and rock materials formed through the process of weathering. Weathering means disintegration and decomposition of the rock.

Instructional Objectives

- 1 To understand the nature of the earth surface and changes occurring on it
- 2 To recognise the tectonic movements and sudden and slow movements taking place on the earth crust

3. To understand the process of gradation as the work of the external force
- 4 To know about the various agents of gradation and their area of work and features created by them
- 5 To recognise the term 'weathering'
6. To differentiate different types of weathering
- 7 To differentiate the features created by erosional and depositional activities of the agents of the gradation/erosion

Concepts

- 1 The earth's surface is subject to constant change due to both internal and external forces
- 2 Internal forces cause two types of movements called vertical and horizontal uplift, and subsidence are the result of vertical movements whereas fracturing, faulting and folding are the result of horizontal movements
- 3 External or exogenic forces cause slow or secular movements
- 4 The process of breaking up of rocks is called weathering
- 5 Exogenic forces are contributed by various agents such as running water, land, glacier, waves and underground water
- 6 Due to erosional and depositional work of the gradational agents new land forms are created

Development/Activities

The process of weathering can be explained with the help of charts or pictures/photographs followed by field

trips to a nearby rocky areas to observe the growth of plants in the cracks of the rocks and also to quarrying sites to understand another type of biological weathering (Fig 2 1a,b,c,d)

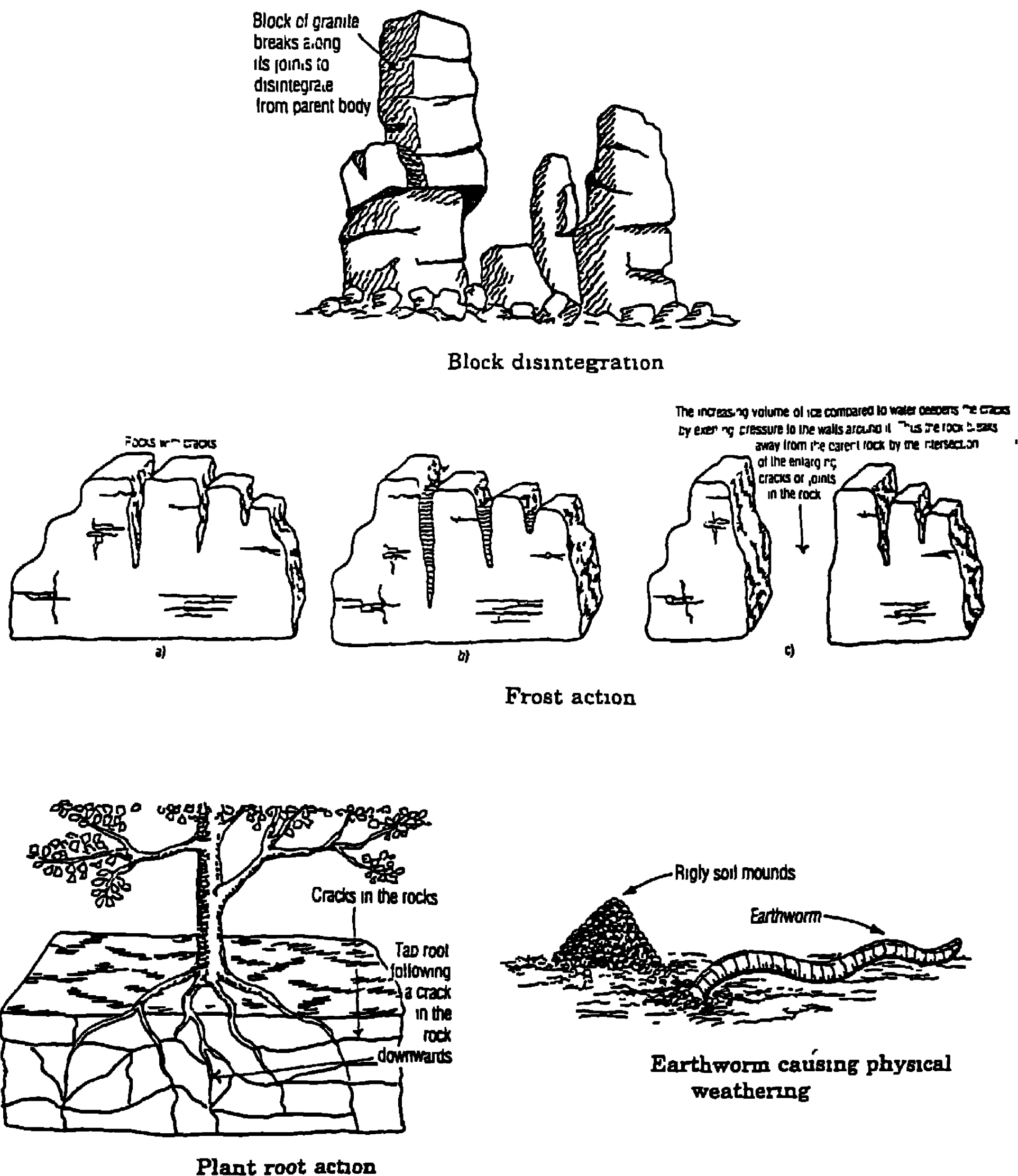


Fig. 2.1.a,b,c,d: Weathering Process

In the classroom, take a glass beaker fill half of the part with water. Add a handful of common salt into it and stir well. Let the students observe and spell out the result. This will help them to understand chemical weathering when certain rocks like limestones, dolomite, etc. will easily dissolve in water.

Home experiment for students: Take a small thin glass bottle with a tight fitting lid. Fill it to the brim with water. Screw the lid tightly on the bottle. Leave the bottle overnight in the deep freezer compartment of the refrigerator. Bring the indicator of freeze to maximum coolness. Observe the bottle after 24 hours.

What did you observe ?

The bottle would have developed cracks. Why ?

1. When the water was in liquid state, it filled the bottle to the brim.
2. When it changed to solid state, i.e. its volume increases and since there is no space to accommodate itself it bursts the sides of the container. The same process happens to rocks in very cold areas, the water that fills the cracks solidifies in the night. Now the space in the crack due to the drastic change in the temperature is not sufficient, hence it exerts force for more space, naturally the crack is expanding. The similar activity continues and the crack is also gets widened. Finally it may break into pieces.

- 3 Take a large piece of lignite or leco coal. Place it on a wire mesh over a tripod stand. Heat the coal from below. When the coal is highly heated it will develop cracks.

The river system can be explained diagrammatically in order to understand how small rivers/channels join to form tributaries and tributaries join to form main streams which ultimately join the main river course.

This can also be explained with a large tree branch. Models made of clay, thermocol, plaster of Paris or plastic clay can be used to depict and explain the various features covered by the different agents.

Models

- a River valley - upper, middle and lower
- b Water fall, cascades, rapids
- c River Meanders, Oxbow lake, Braided channel, Delta, etc.

The teacher should clearly explain the various erosional and depositional features associated with the different stages of river gradation. Action of ground water can be explained in detail through diagram. Ground water table, springs and artesian wells. Action of moving ice should be explained through discussion and using charts and pictures.

What is a glacier ?

How does it erode ?

What are the erosional features ?

What are its depositional features ?

Diagram can be used to explain the above. Thermacol, clay or plaster of Paris models can also be prepared for the same.

Action of wind

Action of wind is more predominant in the arid region. Lack of vegetational cover and moisture will enhance wind's action. Wind erosion can be explained and demonstrated by an experiment.

Arrange three mounds of one dry sand, another wet sand and the third small gravel sand and stone mixture.

Switch on a table or pedestrian fan in speed one on the three mounds.

Observe the effect ?

Why did the sand from the second mound not move ?

Explain

What happened to the third mound ?

If speed is increased to three what happens ?

Is there any change ? Observe, explain why.

Wind erosional and depositional features can be explained through diagrams.

Action of waves

If the school is in a coastal area a field trip can be arranged to the shore and the various features should be explained. Otherwise, the teacher can use photographs, slides, or video cassettes to show the coastal features.

Diagrams can also be used to explain the features.

Teaching Aids

- World map (physical)
- Chart showing the structure of the earth
- Photographs/pictures showing weathering activities
- Beaker, limestone, chalk, etc

- Table fan, sand and clay/sticky soil
- Thermacol models of 'U' shaped and hanging valleys, mushroom rock, sea arch, cave and stacks.

Evaluation

Answer in one or two sentences

- 1 What is gradation ?
- 2 What is weathering ?
3. What is water table ?
- 4 What are Barkhans ?
- 5 What is a beach ?

Write short answers

- 1 Explain the process of freeze action on rocks
- 2 Explain the process of carbonation
- 3 What are the features associated with the middle course' of a river ?
- 4 What are hot springs or geysers ? Explain
- 5 Explain the erosional features in desert areas ?

Match the following

A	B
1 River meanders	1 Water divide
2 Western Ghats	2 Exfoliation domes
3 Orissa	3 River colarades
4 Mahabalipuram	4 River Sharawathi
5 Rusting of iron	5 Great Australian basin
6 grand canyon	6. Emergent coast
7 Jog falls	7 Antarctica
8. Artesian wells	8. Cirque lakes
9 Ice sheets	9 Middle course of a river
10 Tarns	10 Oxidation

Arrange the following land form features in the respective boxes

- 1 V-Shaped valley
- 2 U-shaped valley
- 3 Hanging valley
- 4 Gorges
5. Mushroom rock
- 6 Ox bow lake
- 7 Cirque
- 8 Spits
- 9 Moraine
- 10 Stack
- 11 Rapids
- 12 Bars

Agents	Erosional feature	Deposition feature
River Glacier Wind Waves		

Fill in the blanks

1. The higher ground separating two adjoining drainage basins is called as a _____
- 2 The debris carried by a river is called as its _____
- 3 The gradational process includes _____ and _____
- 4 Sea which is enclosed by a bar is known as _____

STRUCTURE OF THE EARTH

Introduction

Since earth is the basic thing for all geographic studies, it is essential that all aspects/facts of the earth should be studied to know the fundamentals. In that respect it is imperative to study the structure of the earth. The word structure refers to the physical and chemical state of the matter which constitute the earth as a whole. Lots of forces are operating both on the surface of the earth and under the surface of the earth. All these forces not only change the land features on the earth's surface but also have their own effect in changing the environment.

Instructional Objectives

- 1 To understand the materials constituting the earth
- 2 To recognise the nature of materials constituting the earth, both physical and chemical
- 3 To recognise the earth's structure in different layers
- 4 To acquire knowledge about the earth's interior through the forces operating inside the earth
- 5 To understand how the earthquake wave help us to know the details of earth's interior
- 6 To recognise different types of earthquake waves
- 7 To acquire essential knowledge about the depth of each layer and the materials present in different layers.

Concepts

1. The materials constituted in each layer basically differ in their state. both physical and chemical
- 2 The earth is made up of three different types

- 3 The earthquake waves are the main source of information about the earth's interior
- 4 There are different forces that operate in the inner part of the earth
- 5 Each layer of the earth's interior extends to varying depth.
- 6 Each layer of the earth exhibit different properties
- 7 The temperature, density and pressure increases from the surface towards the centre of the earth
- 8 Earthquake waves are also called as seismic waves and recorded by an instrument called seismograph
- 9 The earthquake creates different new landscape on the earth's surface

Development

- 1 Begin the discussion on the interior of the earth using a longitudinal section of an apple showing the different layers
- 2 Draw a cross section of the earth's interior Then compare the parts of an apple - skin, fluid and core with the crust, mantle and core of the earth
- 3 Explain the major components/materials of each layer in detail
4. Explain the paths of earthquake waves diagrammatically
- 5 Through a suitable model or a diagram of a seismograph explain the process of recording the seismic waves The earthquakes are studied by a special branch of Geology known as Seismology (from the Greek word Seismos meaning earthquakes) That is why the instrument recording the shock waves is called the Seismograph

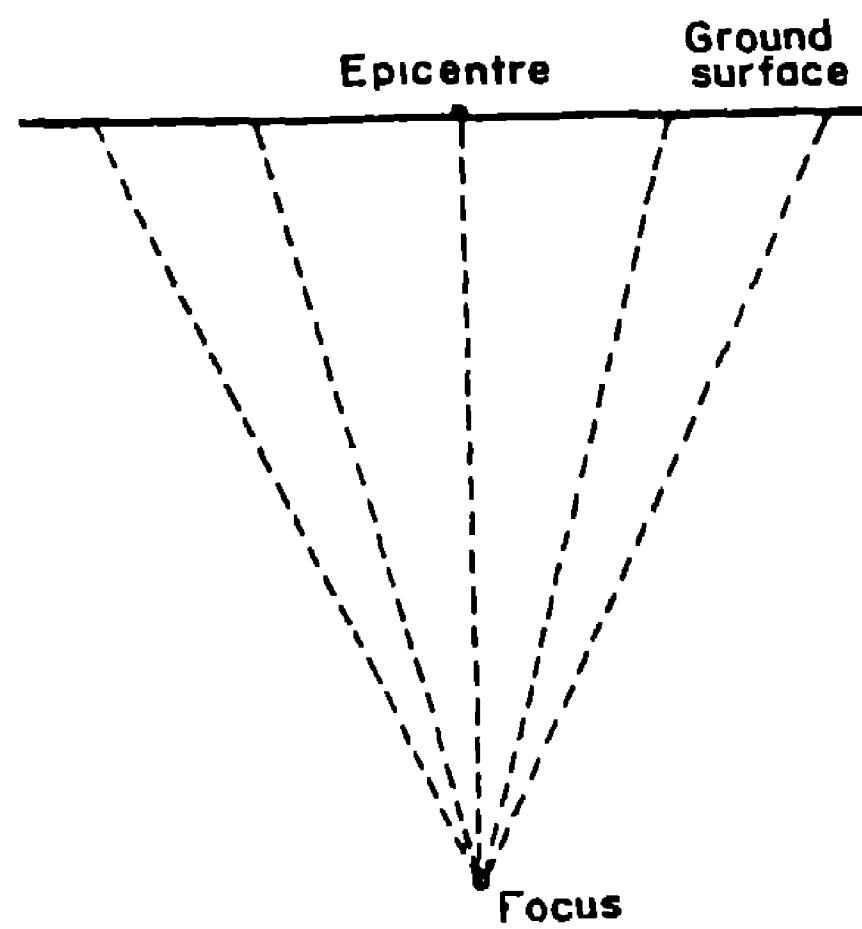


Fig. 2.2: Seismology

6 With the help of the world map the important earthquake zones can be explained

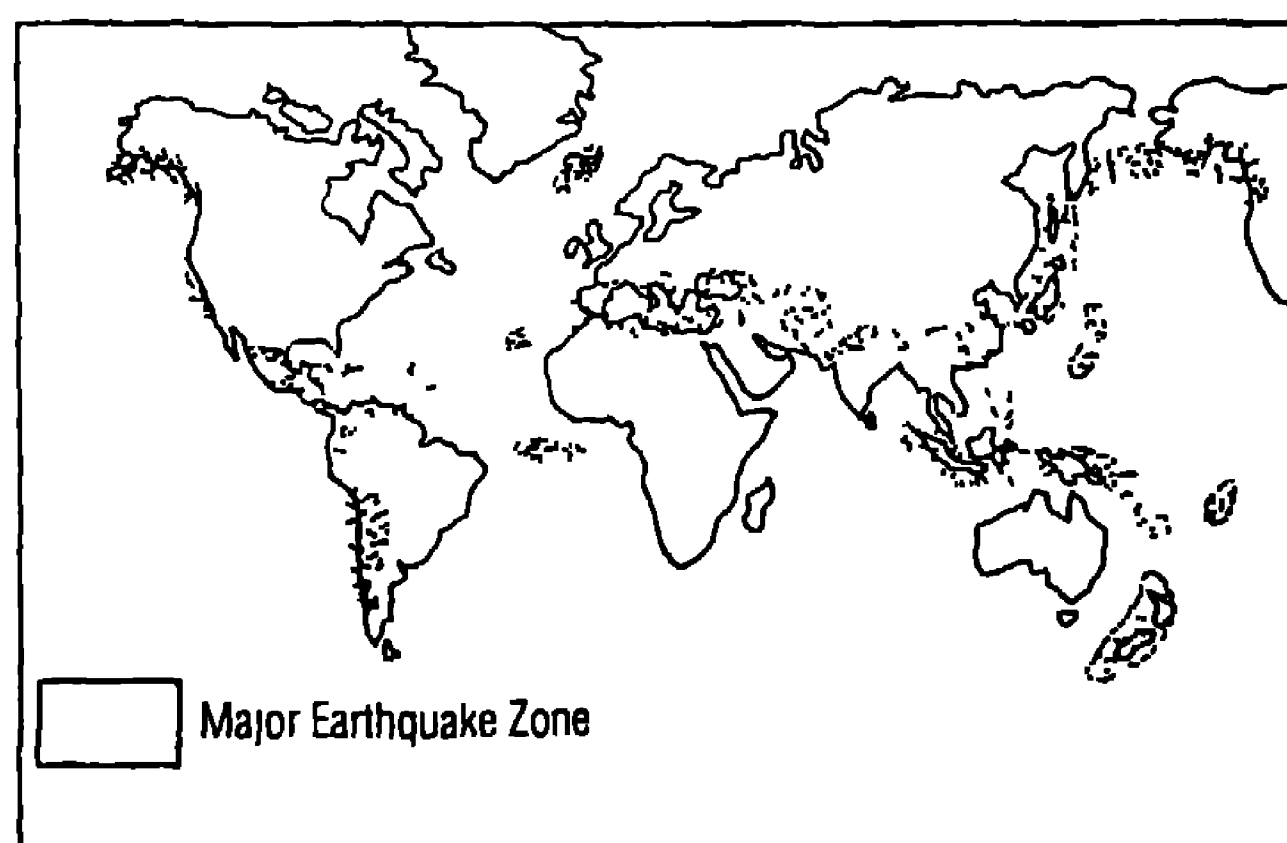


Fig. 2.3: Major Earthquakes Belt of the World

- 7 Ask the students to collect newspaper cuttings and pictures regarding earthquake.

Teaching Aids

- 1 Globe
- 2 Apple (Fruit)
- 3 Diagrams
 - a Cross-section of the earth
 - b Paths of different earthquake waves
- 4 Model of Seismograph

Evaluation

Fill in the blanks

- 1 The interior of the earth can be divided into _____ layers
- 2 Earthquake waves are also known as _____ waves
- 3 _____ is made up of _____
- 4 The core of the earth lies below the layer called _____
- 5 Igneous rocks are those are formed as a result of _____ of molten magma or lava

Choose the correct answer

1. The flesh of an apple can be compared to
 - a core
 - b mantle
 - c crust of the earth
- 2 Which are the fastest of all earthquake waves
 - a Primary waves
 - b Secondary waves
 - c Surface waves
- 3 The radius of the earth is nearly
 - a 3467 km
 - b 6400 km
 - c 2900 km
 - d. 6000 km

4 The instrument which is used to record the earthquake waves is

- a Cardiograph b Ergograph c Seismo graph
d Hydrograph

True/False

1 Alpha waves travel with greater velocity through continents

True/False

2 Temperature increases with increasing depth in the interior of the earth

True/False

3 The sial is denser than the sima

True/False

4 The earth is made up of a number of concentric shells, as layers of rocks

True/False

5 Igneous and sedimentary rocks may get converted into metamorphic rocks

True/False

EARTH'S CRUST - ROCKS AND MINERALS

Introduction

Generally, the study of geography involves the distribution and relationship of things on the earth surface. It is interesting to note that the materials beneath the earth's surface play a vital role in determining the quality of life which exists on the earth surface. Soil is an essential natural resource, which is the by-product of rocks, hence the nature of rock determines the quality of soil on the surface. Science and technology is constantly trying to improve the quality of life through inventions and discoveries. In this way minerals are the basic requirement for a country's development in all aspects.

The earth's crust is composed of different minerals, the aggregate of which form rocks. Rocks differ in their structure and composition depending on their mineral composition and mode of origin. Accordingly, they are classified into three major types - Igneous, Sedimentary and Metamorphic rocks.

Instructional Objectives

- 1 To study the varied nature of the earth's surface
- 2 To know the nature and composition of the earth's crust
- 3 To differentiate between the continental and oceanic crusts
- 4 To recognise that the thickness of continents and oceans varies according to its surface features.

- 5 To differentiate the two such layers of the crust - as sial and sima based on their mineral composition
- 6 To recognise the various minerals and their substances which contribute the crust
- 7 To understand that rock is nothing but an aggregate of minerals
- 8 To know that the nature of rocks vary according to their mineral composition such as hard, soft, porous, non-porous, coarse textural, granular, etc
- 9 To understand the types of rock based on their formation
- 10 To get an overall picture of the main rock types in India and their distribution

Concepts

- 1 The upper most layer of the earth is known as the crust
- 2 The crust constitutes two different layers as sial and sima based on their mineral content
- 3 The lighter sial or the continental crust floats over the denser sima or oceanic crust
- 4 The earth's crust is composed of rocks which actually consist of two or more minerals.
- 5 The nature of rocks differ according to their physical and chemical composition and mode of formation
- 6 Based on the mode of formation rocks are classified into three types as igneous, sedimentary and metamorphic
- 7 Igneous rocks are primary rocks formed by excessive heat below the earth. They are found to lie both below (intrusion) and above (extrusion) the surface of the earth in different shapes

- 8 Depending on the depth of formation and shape they are further divided into many sub-types
- 9 Sedimentary rocks are formed from the sediments accumulated over a longer period of time brought by various agents of erosion such as water, wind, glacier, etc
- 10 The sedimentary rocks are classified as mechanically, chemically and organically formed rocks
- 11 When igneous and sedimentary rocks are subject to excessive heat and pressure, they become metamorphic rocks.

Development

- 1 The teacher can ask a question about the location of the earth crust as an act of apperception
- 2 Explain the layers of the earth's crust (sial and sima, with two diagrams

(a) A cross section of the earth with the crust depicting the sial and sima (Fig 2 4)

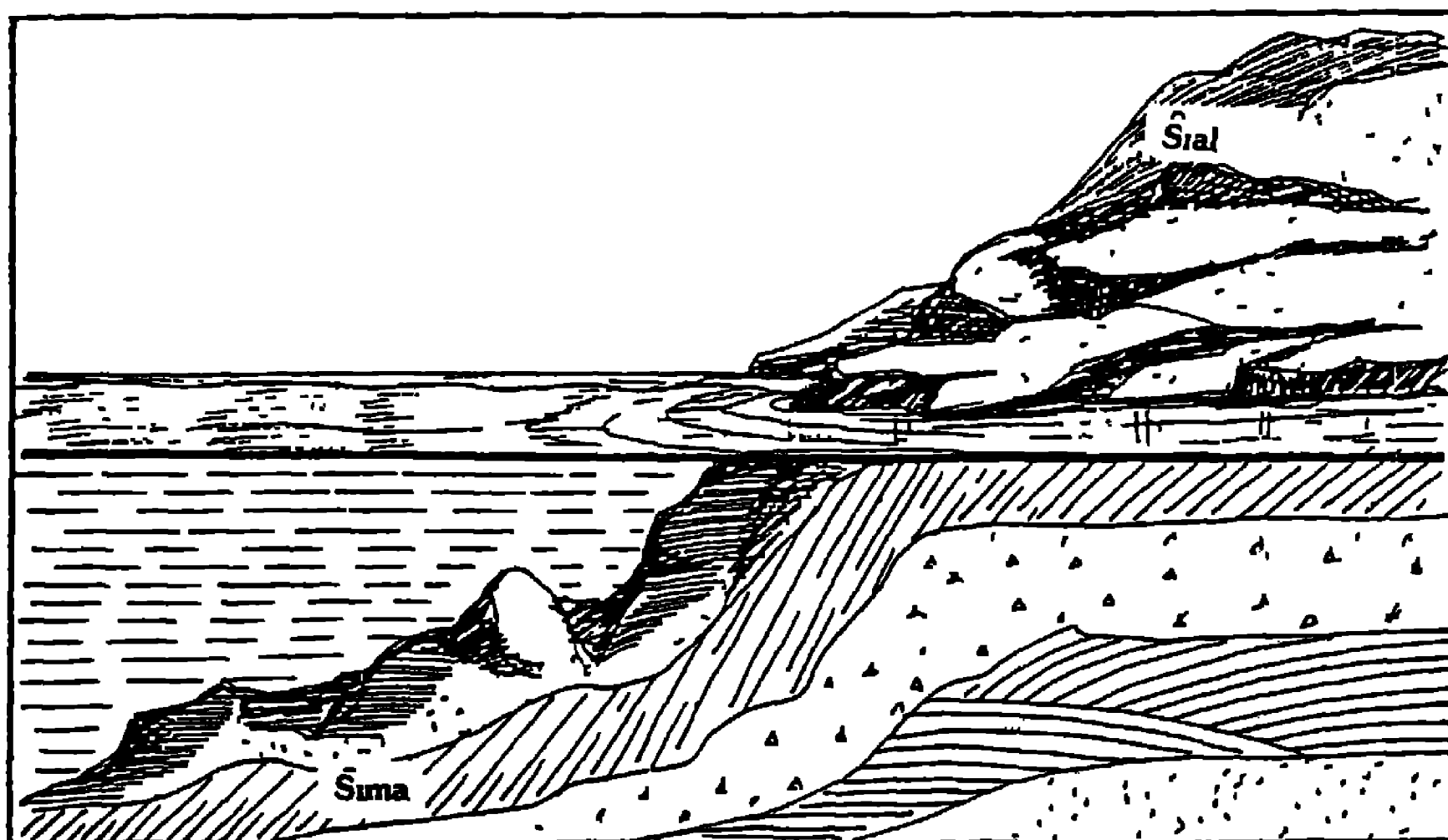
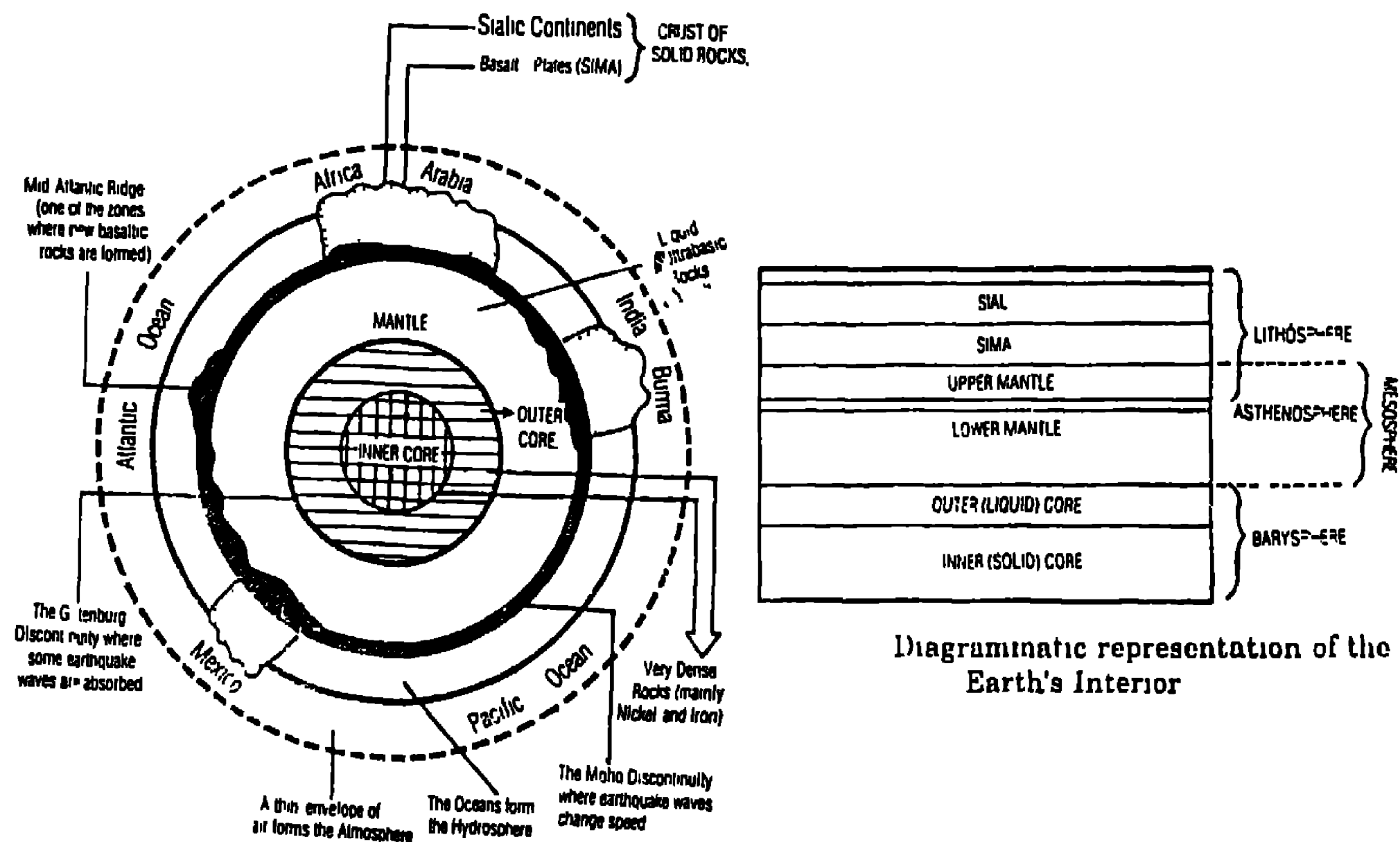


Fig. 2.4: Structure of the Earth Crust

(b) A detailed (enlarged) diagram of part of the crust
(Fig 2 5) depicting the sial and sima



Structure of the earth through a cross section at 20° N

Fig. 2.5: Diagrammatic Representation of the Earth's Interior

- 3 The concept of minerals can be explained through things used every day such as common salt, gold (ornaments, copper (wires, plates, etc), ferrous (building structurals, bolts, nuts, etc), clay (pots), chalk, talc (talcum powder), etc Ask the student to list objects of daily usage by him/her and identify the mineral content
- 4 A chart showing classification of rocks according to their origin (mode of formation) should be prepared to explain the different types of rocks with example (Fig 2 6)

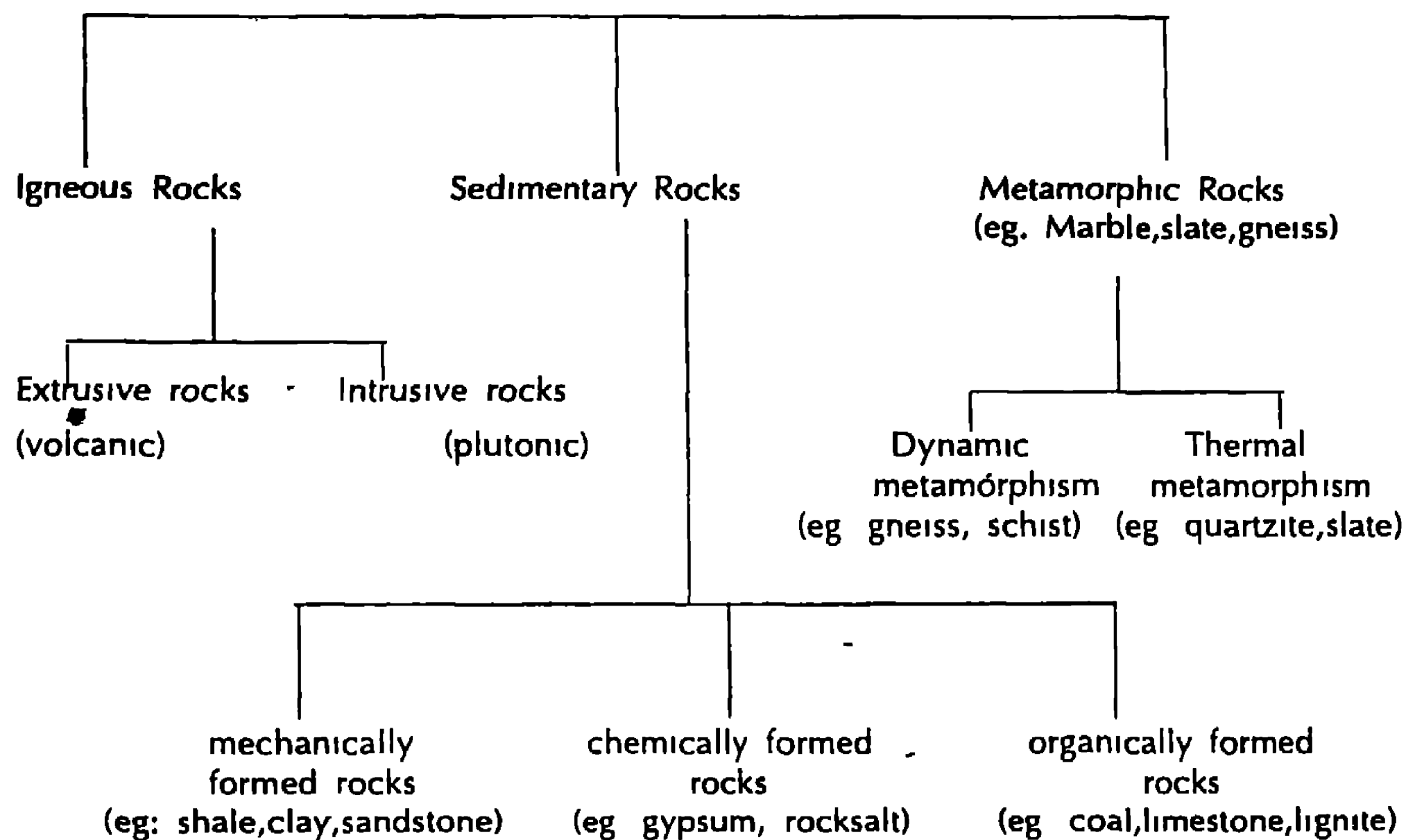


Fig. 2.6: Rocks

5 With the help of rock samples the different types of rocks can be explained in detail by closely inspecting the samples the students will begun to identify the rocks

As an exercise the student should collect rock samples from nearby areas and try to identify the major class of rock it belongs to (hint - easy to identify, granite, marble, slate, coal, pumice, quartz)

6 A suitable chart should be prepared to depict the different types of igneous rocks both intrusion and extrusion so that the difference between the massive, crystalline and compact plutonic rocks and the smaller less crystalline hypabyssal rocks are brought out

- 7 To explain sedimentation the teacher can explain using a glass beaker half filled with water and adding soil, granuel, etc into it This will at once settle down at the bottom due to weight When more substances are added latter they will settle above it

The student should be asked to observe how debris are accumulated in shallow areas after heavy rains in their area/neighbourhood

- 8 The word 'metamorphic' means 'change of form' Under the conditions of either excessive heat or pressure igneous and sedimentary rocks undergo change in colour, hardness, texture, mineral compositions, etc and become metamorphic rock This change can be visibly explained with the help of rock samples (Fig 2 2)
- 9 A map of India showing the main rock types should be prepared on a transparency and projected A political map of India drawn to the same scale on another transparency should be super imposed (placed over) on the first map such that a clear idea of the rock type predominating in each state can be understood

As an exercise the students should be asked to prepare the map by himself

Evaluation

Answer in few sentences

- 1 Define earth^h crust
- 2 What are sial and sima ?
- 3 Define minerals and rock ?

4 What are the different types of rocks ?

5 How are sedimentary rocks formed ?

Fill in the blanks

1. Minerals usually contain two or more simple substances called _____

2 Igneous rocks are also called as _____ rock

3 According to the depth of formation igneous rocks are divided into _____ and _____ rocks

4 The deposit of materials often occur in the form of _____ in the sedimentary rocks

5. Gneiss is an example of _____ rock

True or False

1 The ocean crust is known as sial
True/False

2 Water is the most important agent for the formation of sedimentary rocks
True/False

3. Limestone is composed of shells and skeletons of marine animals
True/False

Match the following correctly

A	B
1 Sima	1 Extrusive igneous rocks
2 Dyke	2 Metamorphic
3. Non-crystalline	3 Stratified
4. Marble	4 Ocean crust
5. Sedimentary rock	5 Slate
6. Shale	6 Hypabyssal rock

Teaching Aids

- Chart showing the structure of the earth
- Cross section model of the earth
- Samples of rocks and minerals
- Material made out of different minerals
- Map of India (political)
- Map of India - major rock types
- Glass beaker and soil with some of the hard substances

EARTH MOVEMENTS

Introduction

The earth crust is subject to vast changes over time brought about by movements known as tectonic movements. These movements are the result of certain forces acting from both within and outside the earth crust. The internal forces are called as endogenic forces while those operating from outside are the exogenic forces.

Some earth movements are sudden such as volcanos and earthquake while others are slow. The slow movements are known as diastrophism and can occur as both vertical and horizontal movements.

An indepth knowledge of tectonic movements and the work/impact of the internal forces operating inside the earth such as volcanos and earthquakes is essential to understand the resultant surface features on the earth crust. All these movements are not to be seen everywhere but they are often taking place in certain parts of the earth. Thus it is essential to identify such areas and to understand the reason for its occurrence that take place.

Instructional Objectives

- 1 To understand that the face of the earth is constantly disturbed by a variety of forces operating within the earth crust and below the earth crust.
- 2 To understand the tectonic movement

- 3 To differentiate the vertical and horizontal movements of the earth's crust and the resultant land features created by them
- 4 To know about the internal forces of the earth
- 5 To understand the origin and types of volcanoes
- 6 To identify volcanic belts of the earth's surface
7. To understand the origin and causes of earthquake
- 8 To locate the predominant earthquake prone areas of the earth

Concept

- 1 The earth crust is subject to undergo various changes
- 2 The tectonic force is confined only to the earth crust, which causes horizontal and vertical movements
- 3 The Himalayas are fold mountains made up of sedimentary rocks
- 4 Earthquakes and volcanoes are the result of sudden internal forces
- 5 Vertical movement causes upliftment and subsidence of earth surface
- 6 Horizontal movement causes folding and faulting of earth surface
- 7 Volcanoes are classified on the basis of eruption as active, dormant and extinct
- 8 Earthquakes are caused due to earth's volcanic activity or tectonic forces
- 9 Volcanoes are concentrated along the circum-Pacific belt and this belt is otherwise known as 'The Ring of Fire'

- 10 Earthquakes occur along the circum-Pacific belt and the mid-world mountain belt

Development

- To estimate the students level of understanding, the teacher may ask a question about the nature of the earth's crust
- Explaining various forces operating within the earth's crust by showing diagrammatic representation on a chart
- Upliftment and subsistence can be explained by operating a model prepared by thermocol

Activity 2

By using paper the teacher can explain the horizontal movement of the crust

- 1 First hold a paper on both ends and apply towards the centre point while doing so the centre of the paper will form a 'fold' This event is similar to the one which is taking place on the earth crust, by which only fold mountains are formed (Fig 2 7)

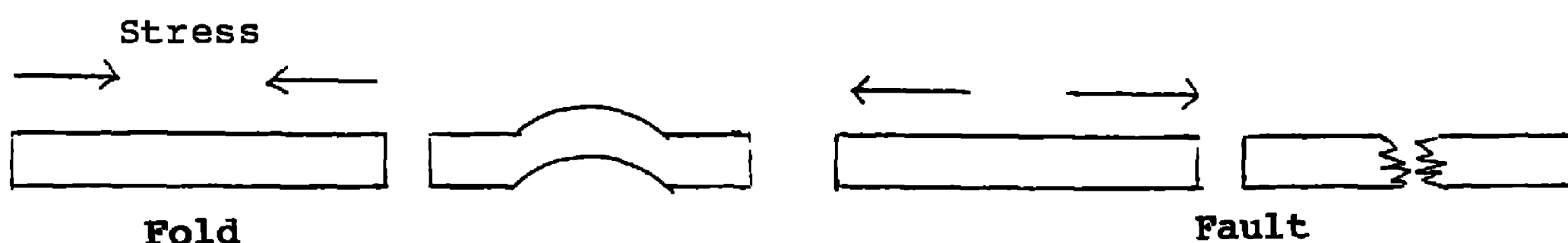


Fig. 2.7: Fold

Fig. 2.8: Fault

- 2 Now instead of sending the force towards the particular point, the force applied from both the hands should be in the opposite direction, while doing so the paper will tear off. If similar process is happening on the earth crust we call it fracturing and when the broken pieces move apart we call it faulting (Fig 2 8)

- 3 Take an elongated block of thermocol and cut it into three parts Name it A, B and C By applying force the blocks can be displaced When the central block is pushed down this resultant model is an graben or rift valley when the central block is pushed up it results in a block mountain or horst
- 4 Parts of a volcanoes can be explained diagrammatically by a chart
- 5 Volcanic eruption can be demonstrated with the help of a model prepared by either clay or plaster of Paris and can be used to show the fuming volcanoes (Fig .2 9)

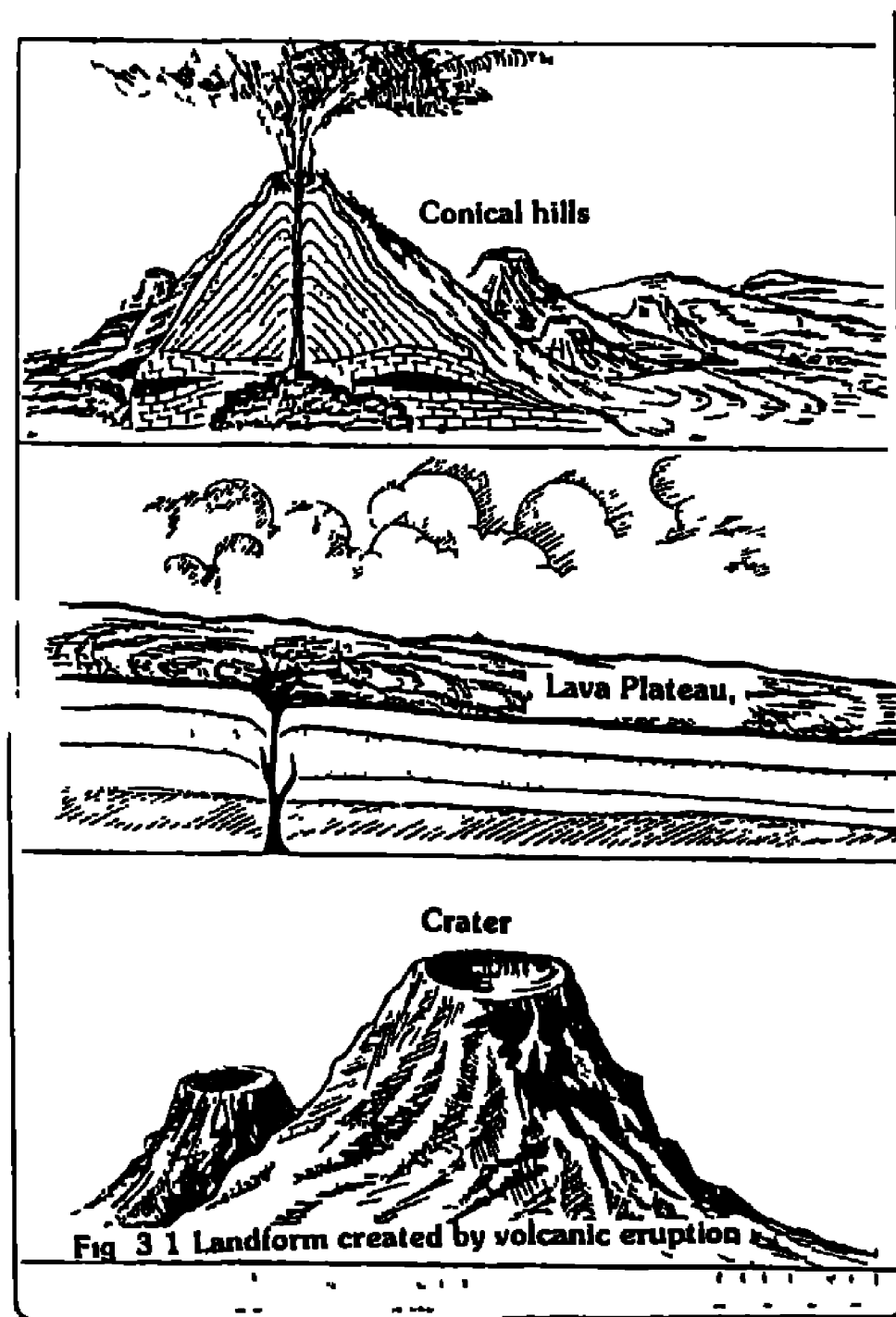


Fig. 2.9: Land Form Created by Valconic Eruption

6 Distribution of volcanoes can be explained with the help of a world map or a globe (Fig 2 10)

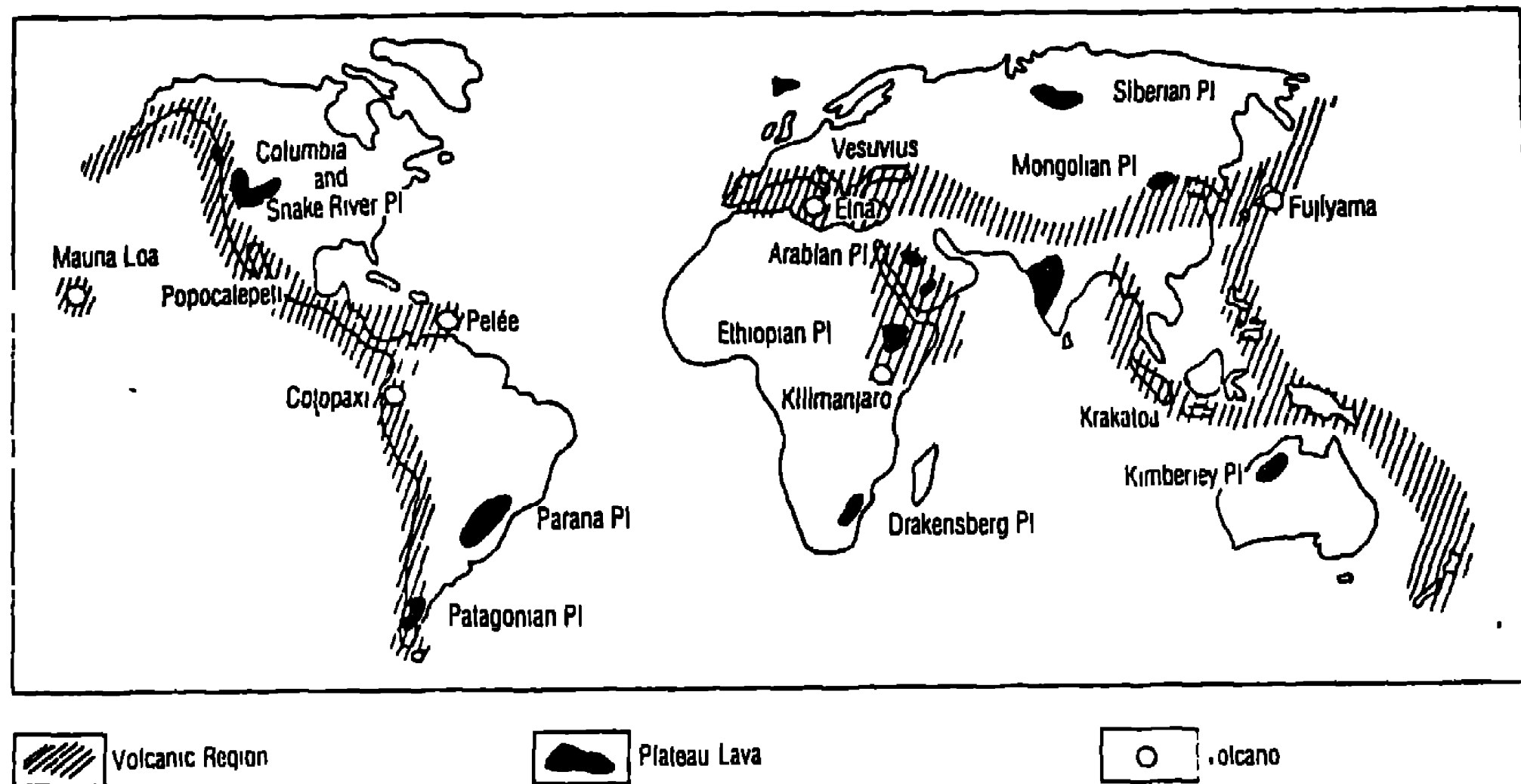


Fig. 2.10: World Distribution of Volcanoes

7 As an exercise the student can be asked to make the volcanic belts on an outline map of the world

8 Distribution of earthquakes can be explained by using a world map or globe

Teaching Aids

- 1 Diagrams
2. Experiment using piece of paper
3. Clay or plaster of Paris models
- 4 Thermocol models for block mountain and rift valley
- 5 Maps

Evaluation

Write brief answers

- 1 How do folds and faults are formed ?
- 2 What do you mean by tectonic movement ?
- 3 What is a volcano ? Mention the types of volcanoes ?
- 4 How an earthquake is caused ?
- 5 Name the two important areas/region which have more volcanic and earthquake activities ?

Diagram

- 1 Draw a diagram of a volcano and name its parts
- 2 Draw a diagram of folding of rocks parts
- 3 Draw a diagram of rift valley and block mountains
- 4 On an outline map of the world mark the dominant volcanic zones

Fill in the blanks

- 1 Upliftment and subsidence of the earth surface are _____ movements
- 2 Fracturing of rocks is caused due to _____ forces
- 3 Mountain building is associated with _____ movements
- 4 _____ results in vertical or transverse displacement of the crust along a line of fracture
- 5 The red sea is a _____

Match the following

Volcanoes	Place of occurrence
Mt Veruvices	Japan
Mt Etna	Manilla (Phillipines)
Mt Cotopaxi	Tanzania (Africa)
Mt Kilimanjaro	Hawai
Mt St Helena	Sicily
Mt Fujiama	Italy
Mt Pinatabbo	Andes (highest volcanoes in the world)

True/False

- 1 The opening at the top of the volcano is known as crater
True/False
- 2 East Africa is a zone of rift valleys
True/False
- 3 The upward folds are known as synclines
True/False
- 4 Hot water fountains caused due to volcanic activity are known as geysers
True/False
- 5 The point from which earthquake waves originate is known as the epicenter
True/False
- 6 The year 1999 witnessed earthquakes in Turkey, Mexico, Ecuador, Taiwan and Chamoli in India
True/False

THE MAJOR LANDFORMS

Introduction

The surface of the earth is mostly covered by water and rest of the area is the land surface. This land surface is not uniform, and we come across varied (nature of land surface) with different levels. These different land surfaces have its own effect on the environment. As per the level of land surface (altitude) they can be classified as plains, plateaus, and mountains. The development of an area basically depends upon the nature of the land surface, which influences the flora and fauna and human activities. Hence it is imperative to have a basic information about different land forms.

Land forms are formed due to two forces, namely, external force and internal force. The external force is a process which includes the work of wind, waves, running water, glacier, etc. The internal process includes the tectonic activities of the earth crust and the activities of the volcano and earthquake.

Instructional Objectives

1. To understand that 'land form' refers to differences in the level of land surface.
2. To understand that the earth surface is divided into land (continents which covering nearly 29 per cent) and water (oceans and seas) which covers nearly 71 per cent.
3. To realise that continents and oceans are first order land forms.

- 4 To realise that both internal and external forces are responsible for the formation of land forms
- 5 To know that land forms are broadly classified into three types - mountains, plateaus and plains constituting the second order land forms
- 6 To realise that each land form has its own effect on both natural and human environment
- 7 To understand the different types of mountains, plateaus and plains and mode of their formation
- 8 To understand the distribution of these land forms on the earth surface

Concepts

- 1 Land forms refer to diversity in level of land surface
- 2 Continents and oceans are first order land forms
- 3 Land forms are the result of both internal (endogenic) and external (exogenic) forces
- 4 The major landforms or second order landforms are broadly divided into (1) mountains, (2) plateaus and (3) plains according to their elevation above sea level
- 5 Mountains are the most highly elevated among the major landforms and are above 900 mts in elevation
6. Based on their mode of formation mountains are divided into (a) fold mountains, (b) block mountains, (c) volcanic mountains and (d) residual or dissected mountains
- 7 A plateau is a highland of over 300 mts elevation with level surface It is also known as 'table land'

- 8 Based on their location and nature plateaus are classified as (a) intermontane plateau, (b) piedmont plateau and (c) continental plateau
9. A flat low land of less than 300 m elevation is known as 'plain'
- 10 Based on their origin plains can be classified into (1) Erosional plain, (2) Depositional plain and (3) Coastal plain.
- 11 Major landforms have got great influence on human life

Development

Activity I

With the help of a world map or a globe the teacher can explain how the surface of the land is covered by water and continents. The teacher may ask the students to look at the map/globe and answer the following questions

- 1 Which covers the maximum area of the earth surface ?
- 2 Explain their nature of distribution in the northern and southern hemisphere ?

Activity II

Explain the broader classification of landforms as mountains, plateaus and plains

Defining each landforms with their specific nature and the minimum level above the sea level

- What is a mountain ?

A mass of land considerably higher with at least 900 m above the sea level and steep slopes

- What is a plateau ?

An area of high land with relatively extensive level surface, is a plateau

- What is a plain ?

A plain is an area of a low and flat surface with an altitude of 300 m above the sea level

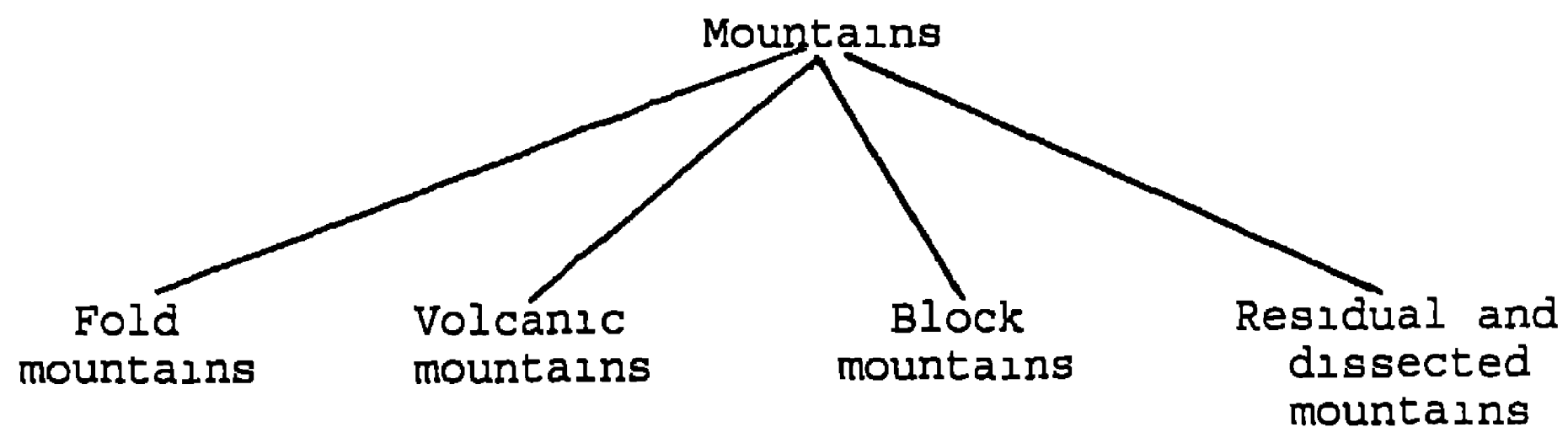
Activity III

With the help of a world map (physical) and their own state map (physical) to show distribution of above mentioned land surfaces.

- Here the teacher may ask few questions related to their local area Such as the nature of the surface, elevation, importance, etc

Activity IV

With the help of a chart the teacher can explain the different types of mountains and about their formation



The teacher can explain the presence of these mountains in the different parts of the world and their impact on the environment in general

Activity V

The teacher can define the plateau with the help of a chart or using the blackboard the different types of plateau and their distribution can be explained with the help of a world map/India map the distribution of plateaus can be shown to the students

Plateaus		----- Intermontane plateau
		----- Piedmont plateau
		----- Continental plateau

Activity VI

The teacher can explain the nature of plain or definition of plain and give the details of different types of plains with the help of a chart or a blackboard

	Erosional plains
Plains	Depositional plains
	Uplifted coastal.plains

Each type of the plain should be explained on the basis of their mode of formation

With the help of a world map the distribution of plain may be shown

Activity VII

The teacher can arrange for a discussion about the importance and influence of these landforms with reference to human life

The teacher can elicit the answers from the students and finally in addition to the points given by the students, the teacher can list out the following

Mountains

- restricts the easy movements of the people
- preserves the natural vegetation and herbs
- helps the wild animals and birds
- offer pleasant climate
- provides recreational and health resorts
- helps to maintain the ecological balance

Plateaus

- provides minerals
- ideal for extensive cultivation
- cause of water falls

Plains

- provides fertile soil
- provides extensive cultivable area
- attracts more people and have high density of population
- gives a favourable condition for the easy development of transport and communication systems
- civilisation flourished in the early period

Activity VIII

The teacher can ask the students to mark the mountains, plateaus and plains in the given outline map of the state/ country and give their importance and influence with reference to environment and economic point of view

Teaching Aid

Globe

World map - physical

Outline map of the world

Diagram on types of mountains, plateaus and plains

Charts and Models

Evaluation

Answer in one or two sentences

- 1 Mention the first order and second order land forms
- 2 Name the young fold mountains of the world
- 3 What is a plateau ?
- 4 What is a coastal plain ?

Choose the right answer

- 1 'Table land' is another name for _____
(a) Depositional plain, (b) Mountains, (c) Plateaus
(d) Valley
- 2 Old fold mountains
(a) Rockies, (b) Ranchi, (c) Alps, (d) Aravallis
- 3 Volcanic mountains are also called as mountains of _____
(a) accumulation, (b) fold mountain, (c) faulting
(d) high peaks
- 4 The Gangetic plain in India is an example of
(a) coastal plain, (b) depositional plain, (c) erosional
plains, (d) uplifted plains
- 5 People are concentrated more in
(a) mountains, (b) plateaus, (c) plains, (d) all the three

Answer in one page

Explain how mountains, plateaus and plains affect human environment

Match the following

A	B
1 Kanchanjunga	1 Old fold mountains
2 Mt Everest	2 Highest mountain peak in India
3 Rackies	3 Highest peak in the world
4 Appalachians	4 Young fold mountain
5 Mt Vesuvius	5 Piedmont plateau (Raf of the world)
6 Black forest	6 Highest plateau in the world
7 Nilgiris	7 Block mountain
8 Malwa plateau	8 Residual mountain
9 Tibetan plateau	9 Depositional plain
10 Delta formation	10 Volcanic mountain

EVOLUTION OF CONTINENTS AND OCEANS

Introduction

We have both knowledge and understanding of the present distribution of land (continents) and water (oceans) over the earth surface. We also understand from the previous chapters that the earth's surface is subject to constant changes both sudden and slow. At this juncture the question arises "Was the distribution of oceans and continents in the past same as it is in the present day ? Has it undergone changes ? How did the changes come about ? Thus leading into the study of the evolution of oceans and continents.

In this regard two hypotheses have emerged to be very important in explaining the evolution of continents and oceans. The first is the continental drift hypothesis proposed by a German scientist Alfred Wegener which states that all the present day continents of the world were together at one time forming super continent called Pangaea surrounded by a large water body known as the Panthalassa. This super continent later broke up into many parts and drifted away from one another resulting in the present day distribution of continents and oceans.

The second hypothesis is known as plate tectonics which explains that the earth surface is divided into six major and many minor plates. These plates are in constant motion and causes both construction and distribution of land forms.

Instructional Objectives

- 1 To recall that the earth surface is composed of continents and oceans
- 2 To infer that the present distribution of land and water had undergone several changes during the process of its evolution
- 3 To recognise two important hypotheses explaining the evolution of the earth (1) Continental drift theory and (2) Plate tectonics
- 4 To understand through the genesis continental drift theory that the light continental sial layer floats over the denser oceanic sima layer
- 5 To know that all the land masses were in a single unit at one time and called as the super continent 'Pangaea' which was surrounded by water body called 'Panthalasa'
6. To understand that the pangaea later split into many parts and drifted from present day continent and ocean
- 7 To know that the lithosphere is broken into major and minor plates
- 8 To recognise that the lithospheric plates have there types of movements such as diverging, converging and sliding on one another

Concepts

- 1 The surface of the earth is constantly changing due to various forces operating both inside and outside of the earth surface.
- 2 'Tectonic' is referred to as the force responsible for deformation of the earth crust

- 3 In the beginning all the continents were joined together and formed a single land mass, which was surrounded by water
- 4 The single land mass or super continent was called 'Pangaea' and the area of this land mass surrounded by water is called 'Panthasala'
5. The single land mass split and drifted apart
- 6 Lithosphere is broken into a number of major and minor plates
- 7 The broken plates in turn are composed of continental or oceanic materials or a combination of both
- 8 The plates move in three ways They move towards one another (converge), move away from one another (diverge) or slide apart on one another causing either construction or destruction of land form

Development

- 1 Video tapes on the continental drift and plate tectonics can be used to give a very vivid picture of the moving continents
- 2 The concept of continental drift can be explained in stages through a series of charts
- 3 The student should have two outline maps of the world He should cut out the culture of continents on one and try to fit them together like a jigsaw. On the other map,
 - (a) Do the continents fit one with the other ?
 - (b) Which two continents fit together ?
 - (c) Do you think there is a possibility of fitting any other two continents ? Try

- 4 The teachers can explain further about the similarities among geological structure flora and fauna and fossils found on either side of the Atlantic ocean
- 5 Even though it had thrown light on the evolution of continents the hypothesis is criticised for the lack of information such as the force which made the continent to drift away and the period and direction of the drift
- 6 The Wegeners hypothesis had paved the way for the development of a new hypothesis known as plate tectonics

With the help of a chart the major plates covering the earth and their movements can be explained

- When two ocean plates bring or move apart forming a fissure through which magma levels up to form new oceanic crust Ex The mid-Atlantic ridge
- When ocean and continental plates converge the heavier oceanic plate tends to sink beneath the continental plate to form deeps or ocean trenches The destroyed oceanic plate causes volcanic activity and earthquakes along plate margins Ex West coast of South America
- When two plate slide past one another they cause fracturing and faulting of areas
- Ex. San Andrian Fault of California

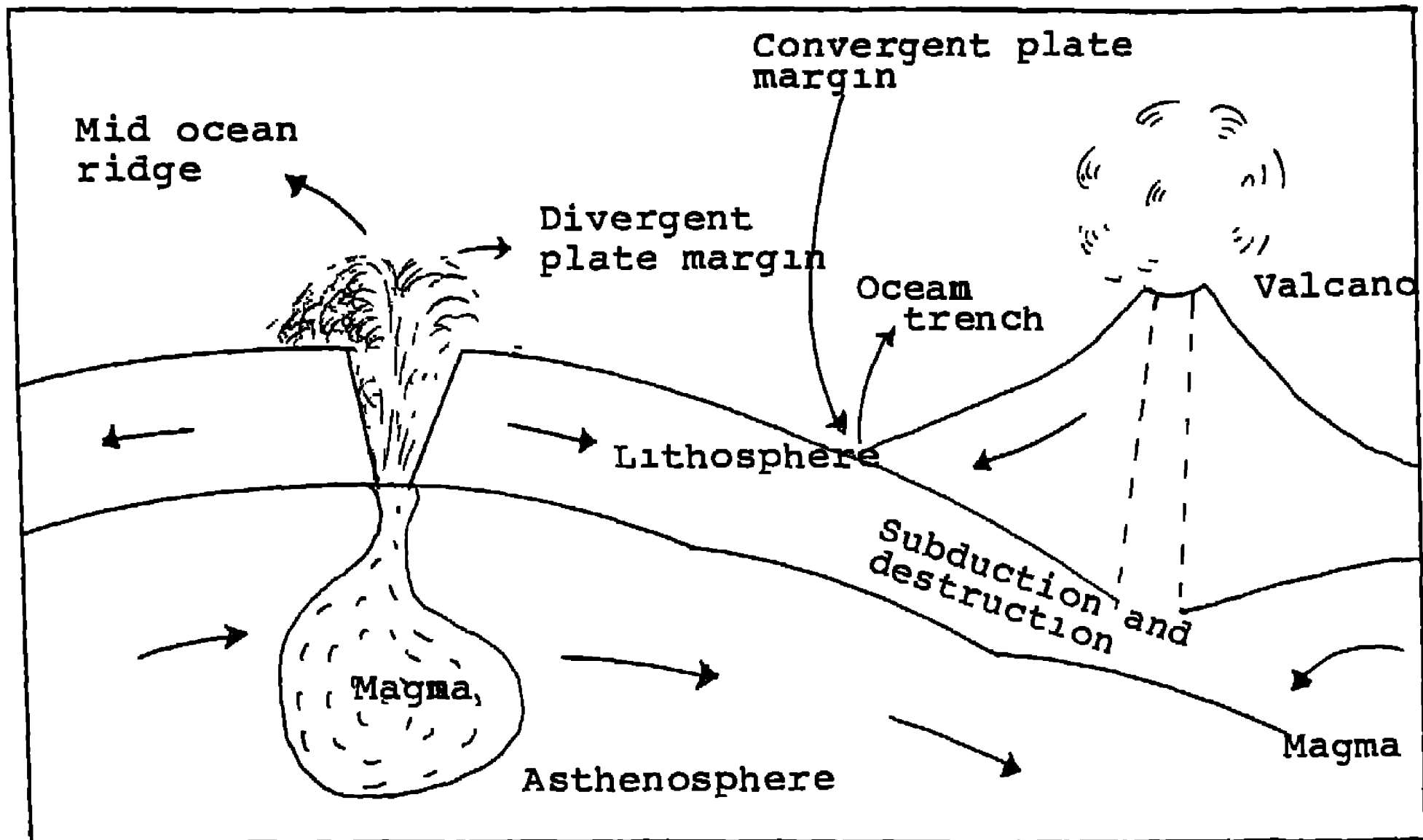


Fig. 2.11: Plate Tectonics

7 With the help of a detailed diagram explain the activities at the divergent and convergent plate margins

Teaching Aids

- Charts showing Pangaia and Panthasala, disintegration of Pangaia and drifting of the land mass
- World map (physical)
- Outline maps of world to be supplied to the students to test the hypothesis of Wegener

Evaluation

Answer in half a page

- 1 Briefly explain Wegener's hypothesis of continental drift ?
- 2 What is a plate ? Name the major plates of the world |
- 3 Explain any two arguments supporting plate tectonic hypothesis.

Fill in the blanks

1. The Pangaea was surrounded by a large ocean known as _____
- 2 Pangaea split up into _____ and _____
- 3 According to Wegener the sheets had covered present day Antarctica, South America, _____ and _____ Peninsula 230 million years ago
- 4 Mid-ocean ridges are a result of _____ plates
- 5 Himalaya were formed due to the collision of two _____ plates

True/False

- 1 Sea flow spreading occurs at divergent plate margins
True/False
- 2 Regions where plate destruction takes place is known as subduction zone
True/False
- 3 Ocean trenches are formed at constructive plate margins
True/False
- 4 The Circum-Pacific belt is a zone of great seismic activity
True/False
- 5 San Andues fault in California (USA) is an example of transform fault

True/False

Diagram

- 1 On an outline map of the world demarcate the major plate boundaries and name the plates
- 2 Draw a diagram to represent divergent and convergent plate margins

HYDROSPHERE

THE WORLD OCEANS

Introduction

The parts of the earth's surface which are internally curved like a concave surface are filled with water. Those surfaces which are very smaller in area are called ponds, a slightly larger area than pond with water body is called lakes. At the same time if it is a very larger pit of area bigger than the pond, pool, lake, etc., it is called a sea. Those water bodies on the earth which are larger than the sea in area and deeper than the sea are called oceans. We have five oceans namely Pacific, Atlantic, Indian, Arctic, and Antarctic oceans. We observe that during summer season the ponds, pools, lakes dry off and are able to see the bottom curved surface or the hard earth which was under the water level. At the same time it is not possible for us to see the ocean floor since the ocean does not dry off. So, if we descend into the ocean and go to the bottom, we can see the ocean floor or the hard earth surface, with various physical features, as we have on the top surface of the earth in the land. The physical features of the land are called as land relief and that of the ocean floor is called as relief of the ocean floor or topography of the ocean floor.

The total huge water body which is connected all throughout the world is called the ocean. But they have been named differently for man's convenience with reference to the nearest landform's name. Water consists of two hydrogen

atoms and one oxygen atom as its composition. The oceans water came on earth due to the cooling down of the atmospheric gases which are swirling around earth, while the earth was formed. These gases further cooled down and turned to become as clouds with huge vapour and started pouring down as rain for a long time. Then the down poured rain water gets collected in huge and large pits on the earth after running down in low lying areas. Of the total water available on earth in various forms 97% of water is available in the oceans as salt water. Remaining 3% of water alone is potable or consumable water, which is available in the form of snow or ice on tall mountains and polar regions. Very less water is available for man in the usable form from ponds, pools, lakes, underground water table, rivers and streams.

Instructional Objectives

- 1 To know the constituents of the hydrosphere
- 2 To know the distribution ratio of land and water on earth.
- 3 To understand that all oceans on earth form a single large continuous water body
- 4 To recall the number and names of the oceans on the surface of the earth.
- 5 To identify the geographical locations of the oceans of the globe
- 6 To recall the area of each ocean
- 7 To compare the area of the oceans with respect to one another and identify the smallest and largest

8 To recall the different deepest spots on different oceans.

9 To recognise the shapes of the oceans

Concepts

a Hydrosphere constitutes of oceans, rivers, streams, lakes, snow, ice, atmospheric vapour and underground water

b The oceans cover 71% of the total area of the earth

c All oceans in the world are connected and form a single continuous water body on the earth

d There are five subsidiary oceans of the world ocean

e The names of those five oceans are Pacific ocean, Atlantic ocean, Indian ocean, Arctic ocean and Antarctic ocean

f Pacific ocean lies between America and Asia in the east and west respectively and Bearing strait and Cape of Adare in the North and South

Atlantic ocean lies in between Europe and Africa in the east, North and South America in the west, Arctic in the north and Antarctic in the south Indian ocean lies between Australia and East Indies on the east, Africa on the west, Asia in the north and Antarctica on the south Arctic ocean surrounds the north pole Antarctic ocean surrounds Antarctica in the south pole

g The areas of the oceans Pacific . 166 m sq km

Atlantic 82 m sq km

Indian 73 m sq km

h. The deepest spots of the oceans, Marianna Trench· 11022 mt

Peurto rico trench: 8648 mt

Wharton trench · 7725 mt

1 Shapes of the oceans Pacific - broad triangle shape

Atlantic - S shape

Arctic - D shape

Development

A. Constituents of Hydrosphere

1 To allow the participants to recall previous experiences, pose them with the following questions which initiate memory motivation and recalling List out the sources of water at various locations on the planet, earth as a whole While listing out the various sources of water on the planet earth the participants to read what they have listed out from their memory and consolidates them on the board by deleting repetitions and irrelevant items Then use a chart to explain the constituents of the hydrosphere These activities will lead to the participant understanding the constituents of the hydrosphere.

2 Bring the World Physical-Wall Map and Globe to the classroom Divide the participants in groups with respect to the number of maps and globes available Give each group a map or a globe or any one Ask them to observe the different colour shapes given for water bodies on the map and ask them to note it down in their notebooks alongwith the depth started in the legend. While doing so the participants are able to identify the various constituents of the hydrosphere and their locations in the world.

B. Number of Oceans and their Names

Provide the participants with a World Outline Map each, and hang a World Physical-Wall Map for their observation. Ask them to look into the Wall Map and colour their map in blue wherever they see the oceans. After this activity has been completed, ask them to find out how many large continuous water bodies are available. By doing this activity, they come to know that there is only one single large and continuous water body available on the earth. Now again ask them to look into the Wall map and mark the names of the subsidiary oceans alone given on it in their coloured maps, with a different colour sketch. Ask them to count and also to read the names aloud. Then explain that the names given are for the sake of man's convenience. This activity helps the participants to know the number of oceans on earth and their names.

C. Location of the Oceans

Provide a World Physical Map marked with boundaries of oceans in different colours for each ocean. Also provide a World Political map to the participants. Now instruct them to find out the names of continents or land masses which form the boundary to the oceans in the North, South, East and West directions, by comparing both the maps. This activity will lead the participants to identify the geographical locations of the oceans of the world.

D. Area and Size of Oceans

Provide handouts like the one given to the participants and ask them to go through the handout and visualise the

size of the ocean by comparing the World Physical map. Also ask the participants to find the location of the deepest spots stated in the handout, on the World Physical map. After this activity, provide empty or plain World maps and ask the participants to mark the names of oceans on the map and beneath it the area in million sq km and also ask them to mark the deepest spots at the right places without seeing the marked wall map. This activity will lead the individual to identify the largest and smallest oceans and also enable to identify the deepest spots and their concerned depths.

E. Shapes and extension of oceans

1. Bring paper cut stencils of triangular, S and D, shape and ask the participants to fix them on the oceans and ask to find out which stencil suits exactly for which ocean. If the participants have artistic view ask them to visualise their idea and demonstrate it to the house. These activities will help the participants to just instantly recall the shape of the ocean and its name in association.

2. Ask the participants to explore the globe in groups and talk about the extent of the area of each ocean, and vastness with reference to the imaginary lines (latitudes and longitudes) mentioned on the globe. Also let them have the handout provided already in section 'C' for understanding the magnitude, shape, extension, vastness and depth of the oceans (which are its specific characteristics). This activity lead the participant to increase the knowledge level.

3 Provide the participants with graph sheets and World Outline map which are of the same size or the size of the graph sheet also should be given. Provide trace sheets too. With the pencils ask them to trace the world outline alongwith the outer border line marked in the original outline map and then ask them to transfer the same to the graph sheet alike. Now ask them to take the graph sheet alone where the outline is marked and ask them to mark the oceans' names on it and its boundaries. Now instruct them to count the number of equal size small squares available inside the land area and the equal size small squares available inside the ocean area separately. Let them mark the individual total separately and also the overall total separately. Now ask them to compare the area in quantified values and find their percentages.

This activity will lead the participants to understand the distribution of land and water on the earth, and very specifically the distribution of water on the oceans alone and the area of the land alone.

Evaluation

1 Provide a World outline map and ask the participants to mark the following

- (a) Atlantic ocean, (b) Indian ocean, (c) Arctic ocean,
- (d) Antarctic ocean, (e) Pacific ocean, (f) Marianna trench, (g) Wharton trench

2 List out the names of the land area which stand as boundaries for the following

- (a) Pacific ocean _____ (Eastern boundary)
 (b) Atlantic ocean _____ (Western boundary)
 (c) Indian ocean _____ (Northern boundary)

3 Match the following.

Deepest spot	Ocean	Area in sqkm
Marianna trench	Atlantic	166
Peurto rico trench	Indian	82
Wharton trench	Pacific	73

4 Spell out one name of each constituent of hydrosphere you know on the earth by looking into World Physical map supplied to you

5 State the deepest and largest ocean on earth

6 List out the characteristic features of the following oceans in the format below

Sl No	Name of the ocean	Shape	Hemisphere	Spread with to size	Your view
1	Pacific				
2	Atlantic				
3	Indian				
4	Arctic				

7. How many oceans are there available on the earth as a whole, how has man named it and for what reason ?

BOTTOM TOPOGRAPHY OF OCEANS

1. Introduction

As one moves from the edge of the land into the ocean water, one descends on the continental shelf. This broad shallow water zone containing canyons, submerged valleys, shelf bars and areas of terrigenous deposits is replaced seaward by the continental slope. The continental slope is a steeper zone that gives place to the continental rise which in its own turn is succeeded at far greater depths by the deep sea plain (or) abyssal plain. The abyssal plain contains ridges, hills, sea mounts, guyots, deeps and fracture zones. Numerous island arcs, atolls, coral reefs, submerged volcanoes and seascapes create enormous variety on the sea bottom.

The great variety of these relief is mainly due to the interaction of tectonic, volcanic, erosional and depositional processes.

2. Instructional Objectives

- To know the various types of physical features (topography) of the ocean floor
- To correlate the physical features on land with that of the ocean floor.
- To understand the definitions of the various topographical subdivisions of the ocean floor

3. Concepts

a Major topographical subdivisions

- Continental shelf
- Continental slope
- Continental rise
- Abyssal plain

b Other subdivisions

- Submarine trench or deep
- Submarine ridge and plateaus
- Guyot
- Submarine canyons
- Islands
- Coral reefs and atolls

The continental shelf is the transition between the land and the actual sea bottom (Fig 3 1a) It is bounded on the seaward side by a depth of 200 metre The shelf covers an area of about 26 million sq km about 7.5% of the global area.

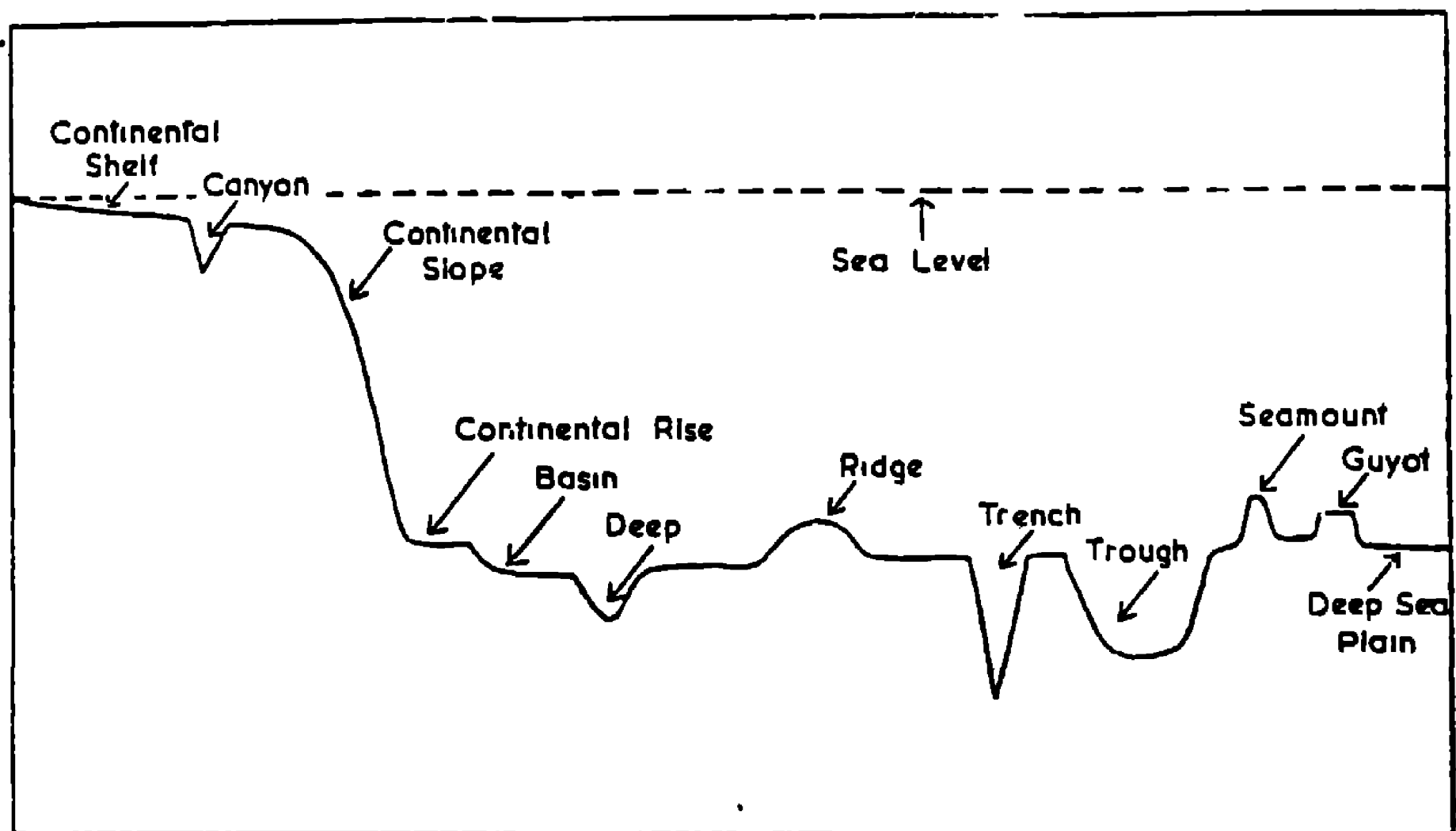


Fig. 3.1a: Topographical Features of the Sea Bottom

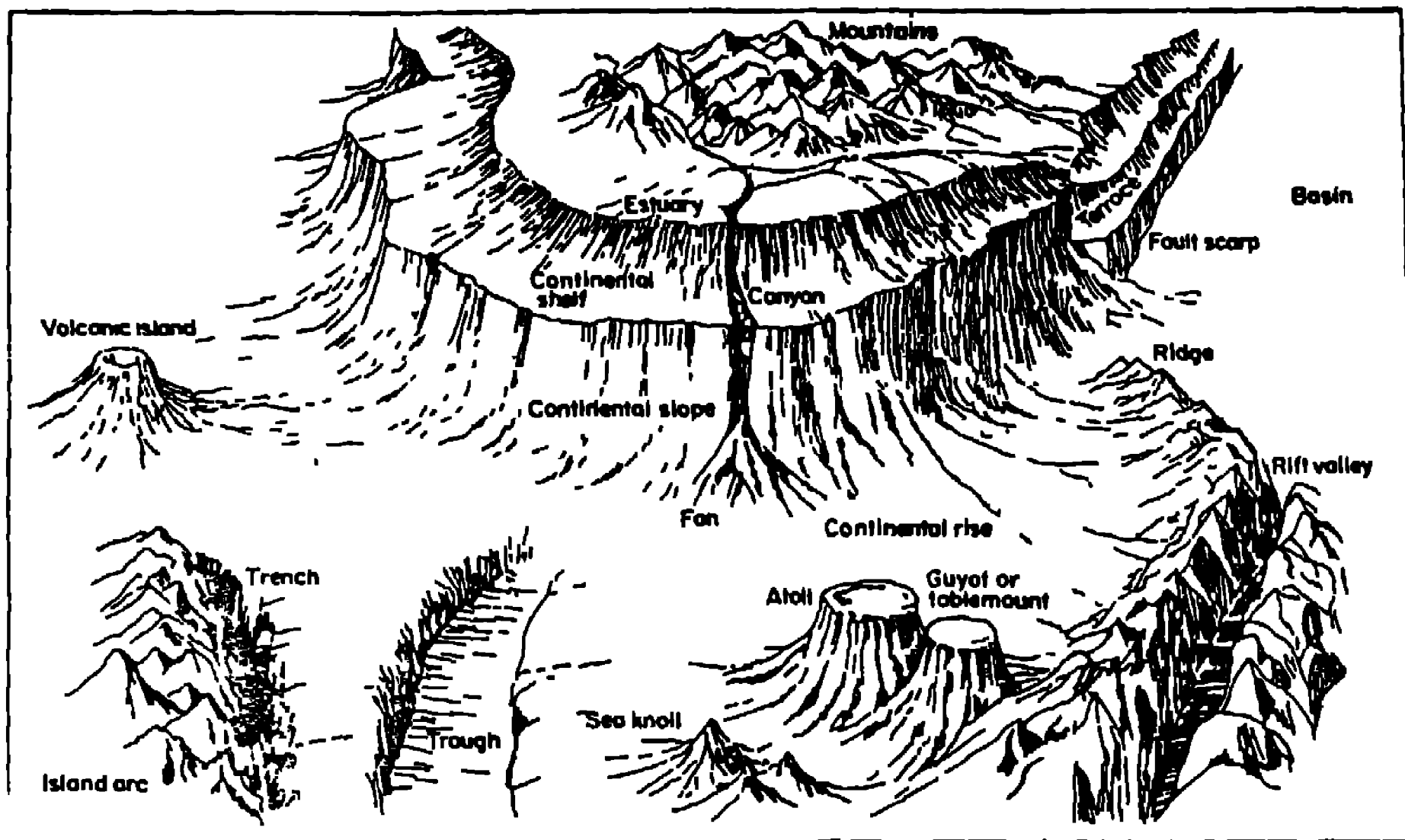


Fig. 3.1b: Major Submarine Topographic Features

The continental shelves are mostly covered by sediments derived from rocks and the shelves of the world are of great use to man, since they provide the richest fishing grounds. About 20% of the world production of petroleum and gas comes from shelves.

The continental slope. At the edge of the continental shelf the seaward slope becomes considerably steep. The angle of slope varying from 2° to 5° .

This continental slope descends to a depth of 3660 mts from the mean sea level, and joins the continental shelf to the deep ocean floor. It covers a small portion of 8.5% of the total oceanic surface.

The continental rise

The continental rise located at a distance of 400-700 km from the shore, and is deep from 3 to 4.5 km after the

continental slope. With increasing depth the continental rise becomes virtually flat and it merges with the abyssal plain.

The abyssal plains

These occupy 40% of the ocean floor

They are present in several oceans and seas in the world

They are uniquely flat

They are bounded by hills on the seaward side They are covered by sediments

This is covered at a distance of 700 to 1200 km from the sea shore and at a depth of beyond 4 5 km to 5 km.

Submarine trenches

They are deep sea elongated depressions, mostly aligned with continental margins (Fig 3 2)

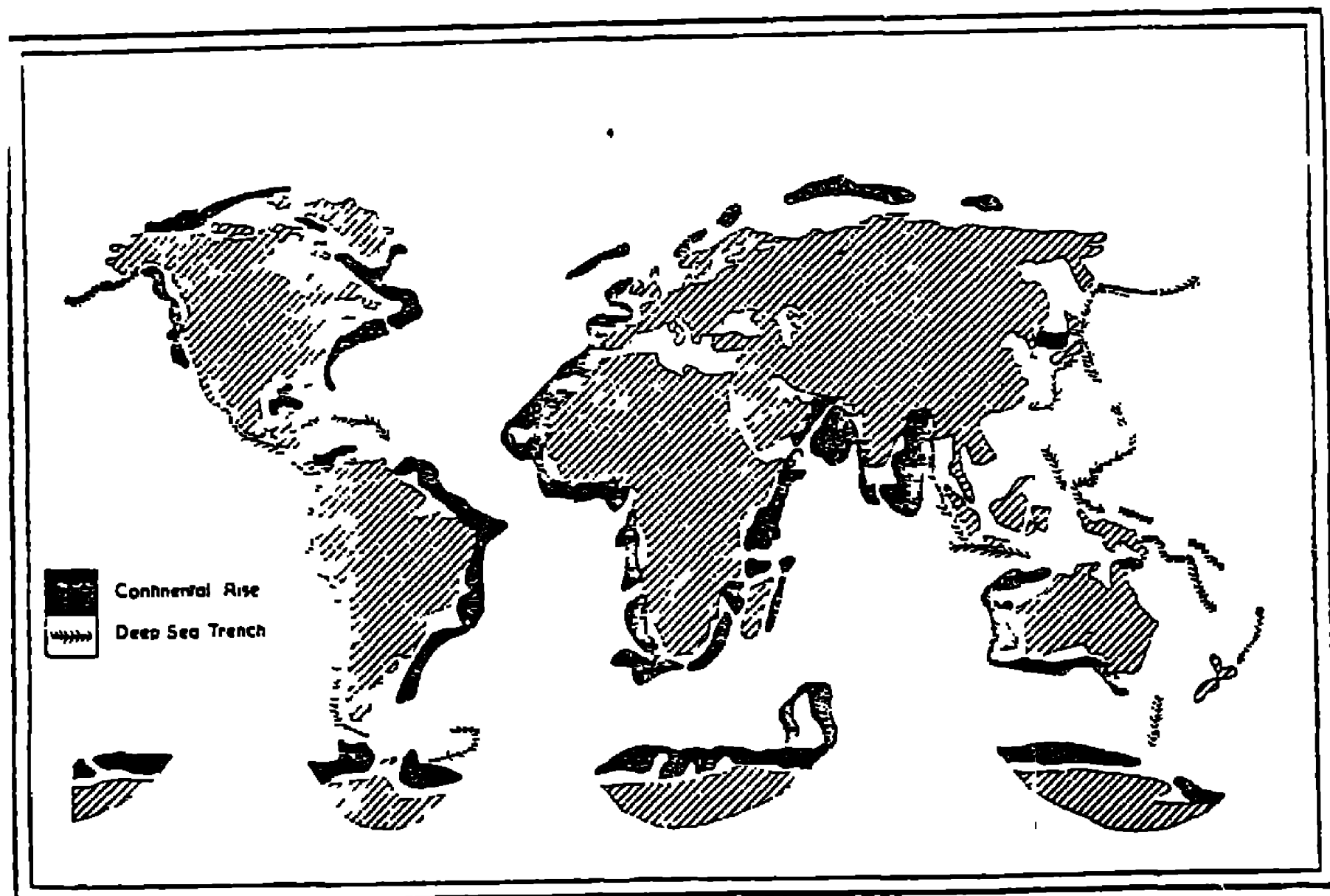


Fig. 3.2: Distribution of Continental Rise and Deep Sea Trenches

Recall the depth of deepest Mariana trench which is 11022 mts Trenches are only 100 mt wide but more than 1000 km deep

Submarine ridges

They are elongated high features on the ocean floor They extend upto 60,000 km in length and 10 km in height The ridges are either broad, gently sloping rises (or) steep sided narrow submarine mountains

Guyot

Flat topped sea mounts are called guyots A submarine mountain or peak rising more than 100 mts above ocean floor is known as sea mount

Submarine canyons

They are deep gorges or strikingly deep valleys with steep slopes found mainly on the continental shelf, slope and rise.

Reef and Atoll

A reef is rocky or coral elevation having a generally elongated shape Within the reefs are flat and shallow areas filled with sediments Reefs are generally 190 km long and 160 km wide

The most widespread are the reefs associated with atolls and formed by coral organism

4. Development

1. a. The teacher is to prepare a 3-D wax model of the topographical subdivisions of the ocean kept in a rectangular glass tub with water and asks the participants

to come in small groups to observe, touch and feel, the various shapes

b The teacher then shows the topography sheet of the ocean floor and asks to find out the four main topographic forms

Students on doing these activities find out the four main topographic forms of the ocean as Continental shelf, Continental slope, Continental rise and Abyssal plain

2 Teacher prepares the following diagram in a big chart and asks the participants to view it, observe the conspicuous features depicted and read the concerned nomenclature given nearby (Fig 3 3)

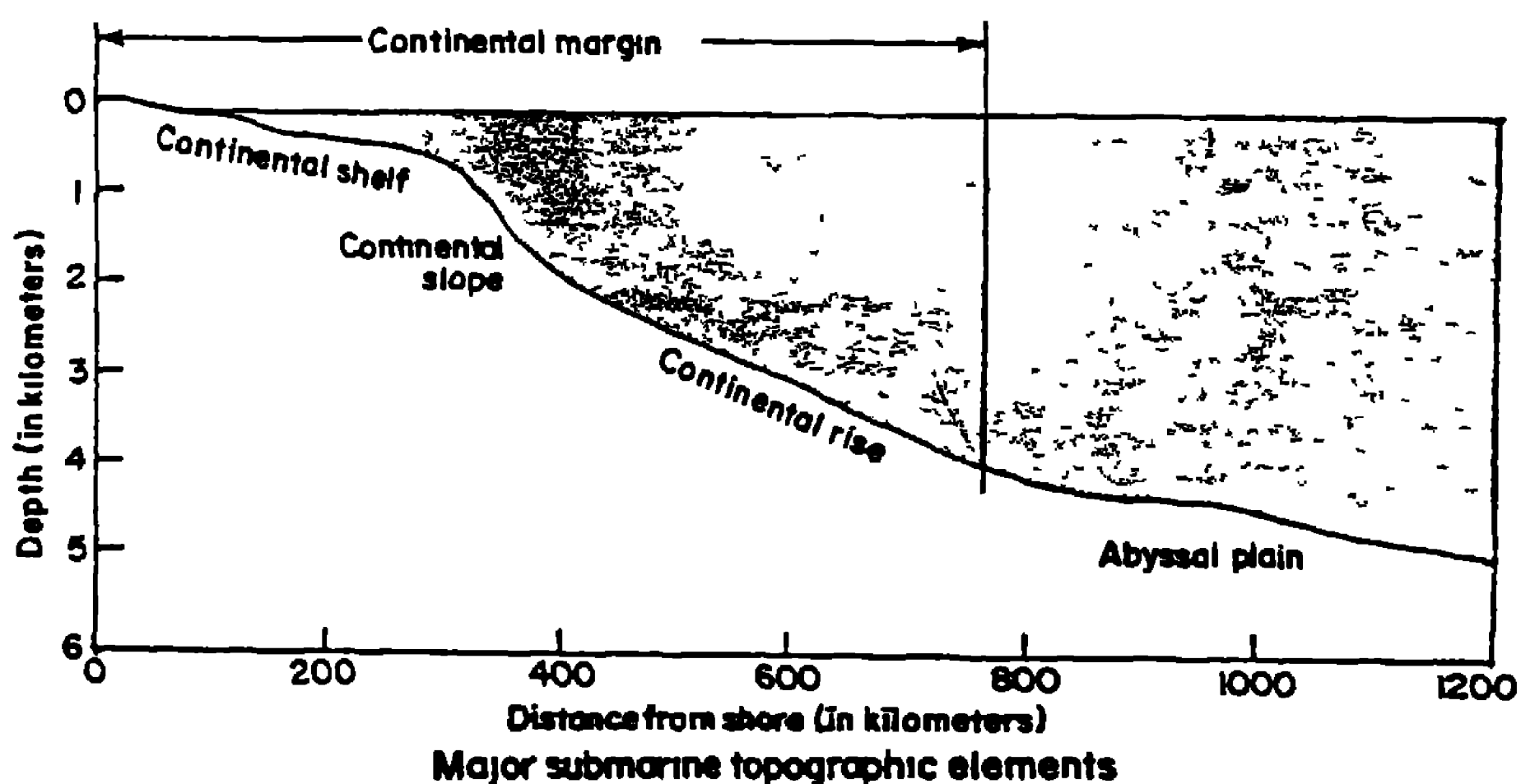


Fig. 3.3: Major Submarine Topographic Elements

Also the teacher has to demonstrate to the students with the 3-D wax model the location of submarine trench, submarine ridge, Guyot or Abyssal hill, submarine canyons,

and asks one or two students to bring about the above features by working on the wax model and the other students are asked to view the same independently and identify the features

While doing this activity, the participants identify and are able to recognise the various submarine topographical features like

- Submarine trench
- Submarine ridge
- Abyssal hill or guyot
- Submarine canyons

3 Prepare a comparative analysis chart of physical features of land and ocean

- Abyssal hill or Guyot
- Submarine canyons

4 Prepare a comparative analysis chart of physical features of land and ocean side by side and ask the participants to compare the physical features on the land and their names with that of the topography of ocean floor and their names and then list them out parallelly. The chart should have thermocol cutouts for the physical features. While doing this activity the participants co-relate the physical features of land and ocean

5 Prepare flash cards wherein on one side paste 2-D projection of the oceanic relief cutout from the thermocol and on the other side its definition and use it in the class while teaching.

While doing this the participants gain the skill of associating the physical features and its definition together

5. Evaluation

- a Name the major topographic features
- b Define the following
 - Continental shelf
 - Abyssal plain
- c Place the flash cards arranged on a table so that the relief side faces up Call the students one by one and ask them to identify the particular relief you indicate and also ask them the definition of the same
- d Show the wax model of the ocean relief features and ask the participants to identify the following
 - i Submarine trench, ii Submarine ridge, iii Abyssal hill

TEMPERATURE AND SALINITY OF OCEAN WATER

1. Introduction

Temperature and salinity of ocean water are the two basic properties which determine (a) the movements of large masses of water, (b) the characteristics of water and (c) the types of marine flora and fauna.

A. Temperature

Temperature of the top surface of the ocean varies throughout the world. Temperature of world below the surface of the ocean also varies according to the depth. There are two main processes through which the oceanic water is heated. They are

- a. absorption of radiation from the sun, and through
- b. convection, which means the transmission of heat by actual movement of heated molecules of fluids from heated portions to colder portions of the same fluid.

The sea surface temperature decreases with respect to increase in distance from the equator. In Atlantic ocean, surface temperature near the equator is 20° celsius and as we move far away to 70° N latitude on the same ocean, surface temperature is 5° celsius.

The temperature of the ocean surfaces vary throughout the various months of the year due to change in seasons on the earth.

B. Salinity

Oceanic water contains a large number of dissolved salts, and that is why the sea water is salty. The salt in the ocean waters are ultimately derived from the earth's crust. Sea waves and rivers erode the crystal rocks and dissolve their constituents and add them to the oceanic water.

The distribution of salinity has two aspects (i) horizontal and (ii) vertical, i.e. the amount of salinity varies with respect to area and depth (Fig. 3.4)

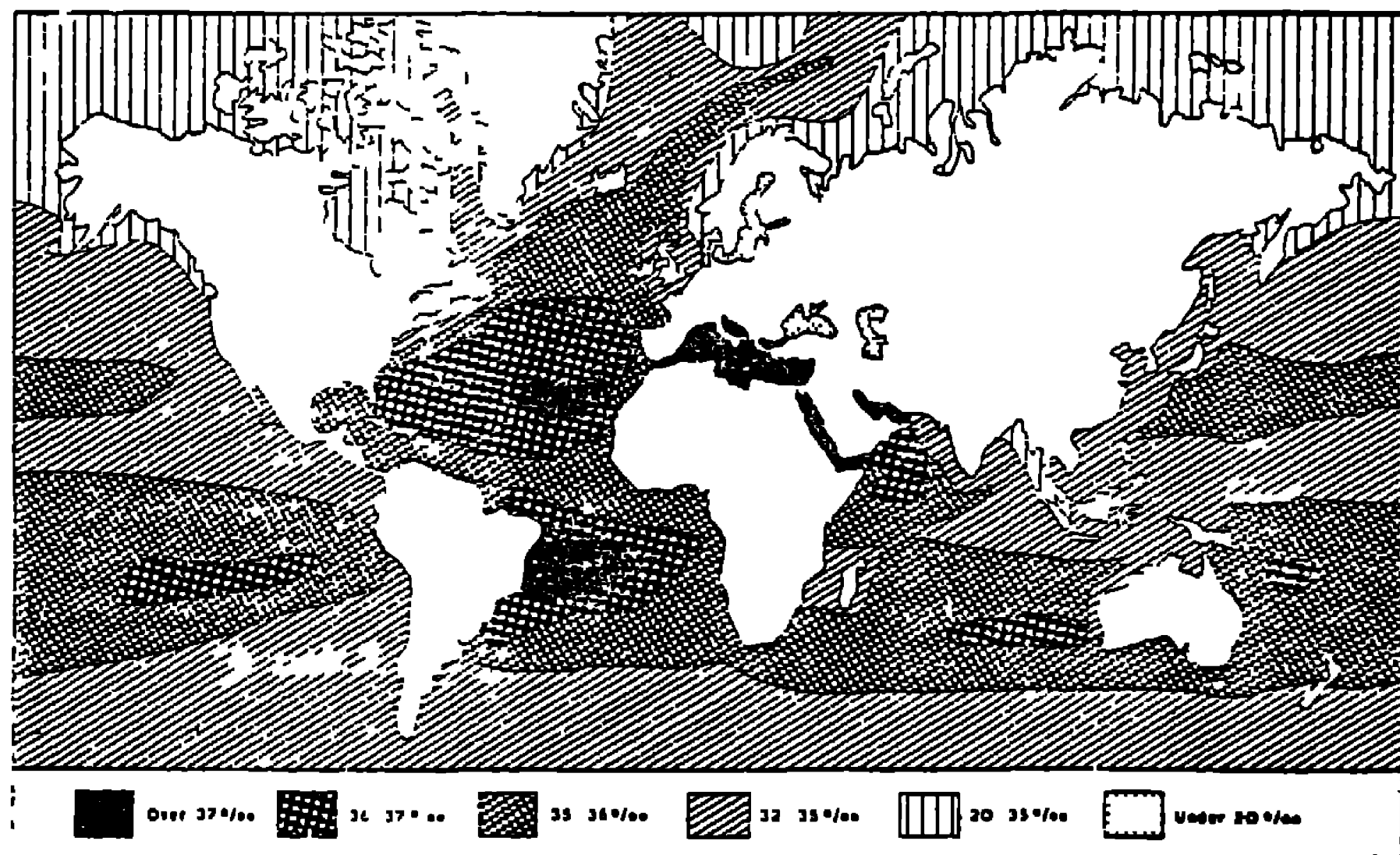


Fig. 3.4: Distribution of Salinity

These variations of salinity are because of evaporation, precipitation, flowing in of river water, atmosphere pressure, wind direction and movement of the sea water. Along coasts, salinity is lowered by flow of fresh water. In open sea

salinity is high due to evaporation, precipitation and ocean currents.

Instructional Objectives

- a. To know that the ocean surface gets heated due to temperature rise
- b. To identify the causes of temperature rise in the ocean.
- c To identify the variations of surface temperature of oceans
- d To know the causes of salinity of the ocean.
- e To understand that salinity varies with reference to certain factors.
- f To identify the distribution of salinity throughout the ocean in the world

3. Concepts

- a Water surface gets heated as the land thereby rising its temperature
- b Absorption of radiation and convection are the processes by which ocean surface are heated
- c. Surface temperature of oceans vary with reference to location on the earth surface
- d Dissolved salts carried by river water into the sea accounts for salinity
- e. Factors like evaporation, precipitation and flowing of river water into the ocean causes change in salinity
- f Salinity distribution is uneven horizontally and vertically throughout the world oceans.

4. Development

(1) Temperature and Ocean Water

Activity

Recall from the memory of participants their experience, when they have realised the hot upper level of the water in the bucket or container in their house left outside on the summer day, and cold lower levels of water in the same bucket. Ask how the water temperature has risen in the upper level and not in the lower level.

Then explain that it is due to two reasons that it has become hot

1. Absorption of radiation and

2. Convection

a. Tell this example below to explain radiation

We get warmed up when we stand in the hot sun for sometime. Likewise water in containers in our house laid in the sun gets warmed. How ?

Heat energy from the sun is transmitted through free space without participation of any material medium. This phenomenon of warming takes place due to radiation absorption.

b. Tell the below example and explain convection

Here recall that a gas expands when heated thereby decreasing the density, thus the air immediately surrounding the fire gets heated immediately, expands and decreases in density. Consequently the warm air is pushed up by the surrounding cooler air. This updrift of warm air will

envelope ones palms held above fire. Thus the medium air itself is transporting part of heat here. The transfer of heat by fluid motion between regions of unequal density that results from non-uniform heating

Thus in convection, heat energy is transmitted from the hotter portions of a fluid to the colder portions by the actual movement of the more energetic molecules from heated portions.

c Draw a diagram for distribution of ocean temperatures in a chart and ask the participants to observe the changes in temperature on world oceans

Ask them to observe the change in temperature according to different latitudes

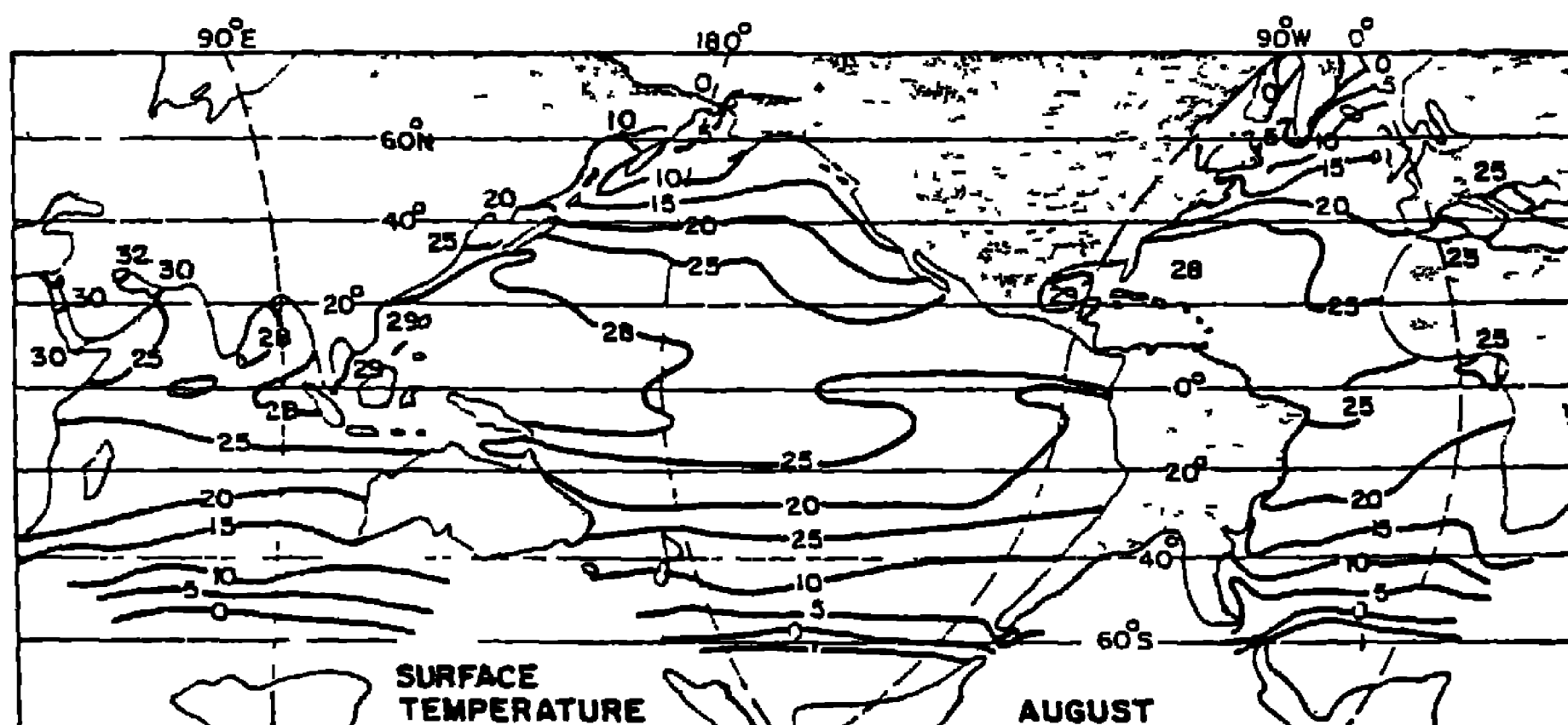


Fig. 3.5: Distribution of Temperatures

While doing this, they would identify the variations in temperature at various locations on the world oceans

(11) Salinity

- a Bring a cup of concentrated salt water and a cup of fresh water. Now call a student and ask him to taste both the water separately. Ask him which is saline? And how far? Then ask him to pour the cup of saline water in a different big tub and then ask him to add the fresh water slowly and completely. Now ask him to taste the same. Question him about the concentration of the water in the tub. After tasting the water he would say and says that the concentration has reduced. Now show him the map of the rivers in India and ask him to find out where the rivers drain and what will happen to the salinity of the sea where the rivers drain.

By this activity they understand that flow of fresh water is a cause of variation (reduction) in salinity.

- b Likewise show a chart indicating the evaporation process from saline water. Chart should show the reduction of water level, stage by stage and at the final stage with only salt and no water. Ask the students to observe closely the stages from 1st to last and then close the last stage and ask about the taste of water in the previous stage of crystallisation of salt. Then further close all the stages except the 1st one and now ask what will be the taste of water in that glass when compared to the last but one cup. The participant realises that salinity increases with reference to evaporation.

c Show the following picture drawn on a chart to the participants. Also mark latitudes on the picture. (Fig 3.4)

Now ask the participants to observe the varying salinity areas and to compare the same with the world physical map and ask them to list out the concerned oceans or seas and their salinity level in the following format

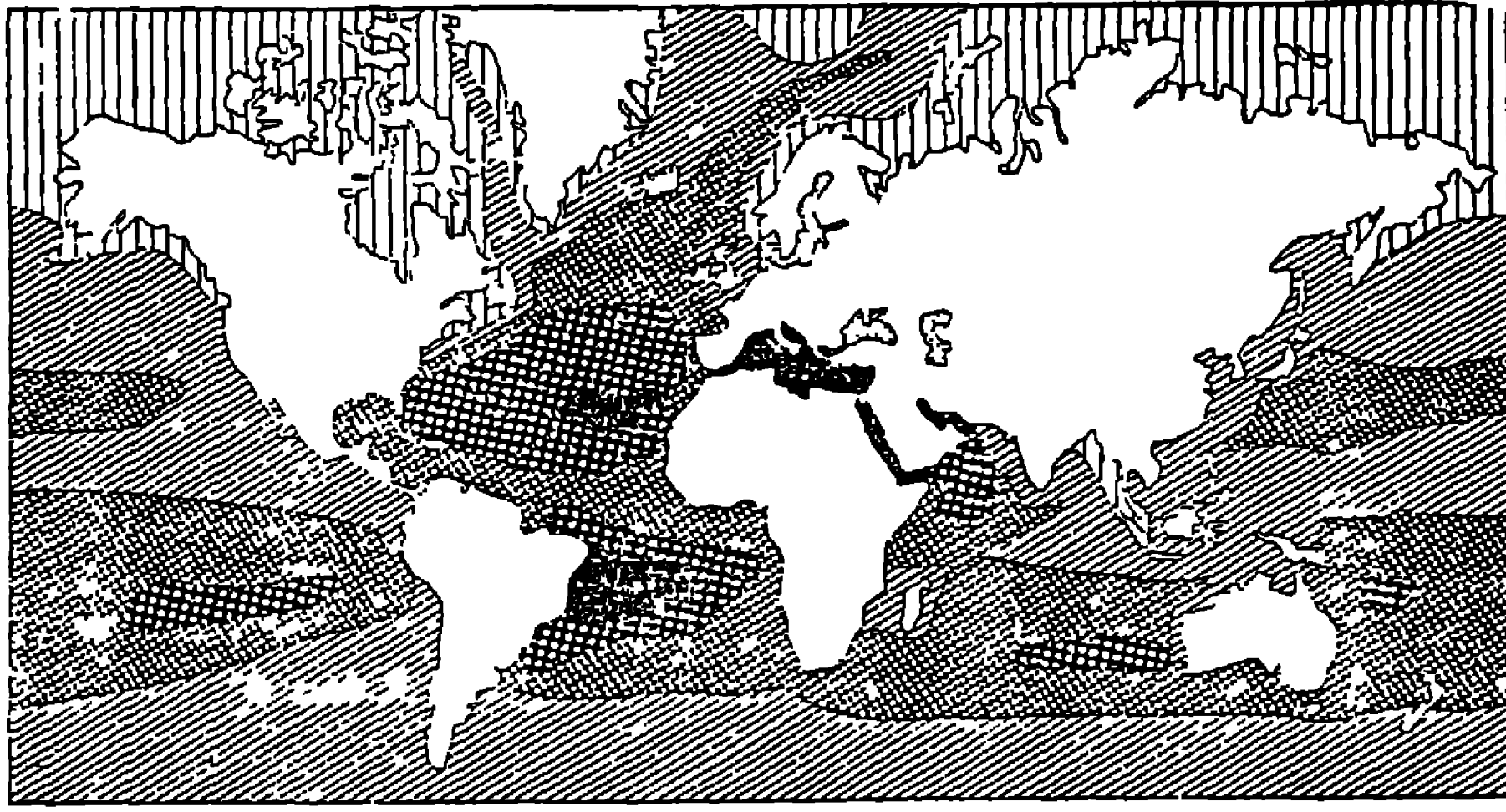
Sl No	Latitude	Name of ocean/sea	Salinity
1			
2			
3			
4			

After this activity ask them to compare and find out the change in salinity with respect to the latitude By this activity the participants will be able to identify the change in salinity with respect to the latitudinal variations

5. Evaluation

- 1 Provide a distribution of salinity map to the participants and ask them to locate high saline areas and very low saline areas. Also ask them to reason out why the difference is there
- 2 What are the causes for the rise of temperature of ocean surface ?
- 3 Explain the process of temperature rise of ocean surface due to radiation.

- 4 What are the reasons for variation in temperature of ocean surface ?
- 5 Show the picture to the participants Also mark latitudes on the picture



- 6 Now ask the participants to observe the varying salinity areas and compare the same with the world physical map and ask them to list out the concerned oceans (or) seas and their salinity level in the following format.

S1 No	Latitude	Name of Ocean/Sea	Salinity
1			
2			
3			
4			
5			
6			

After this activity, ask them to compare and find out the change in salinity with respect to the latitude By this activity the participants will be able to identify the change in salinity with respect to latitudinal variations

MOVEMENTS OF OCEAN WATER

Introduction

Nothing is permanent, and everything is bound to change. Following suit, the ocean water experiences three types of movements. They are.

(a) Waves, (b) Tides and (b) Current

Waves

The ocean waves are the oscillating motion of the sea surface. The rise and fall of the surface level of water indicate this. The friction of wind against the surface of water forms the waves. Once the surface is disturbed and its form is changed, there is a push against the rear, suction over the crest, pull at its front and vertical compression in the trough as shown in figure below (Fig 3.6)

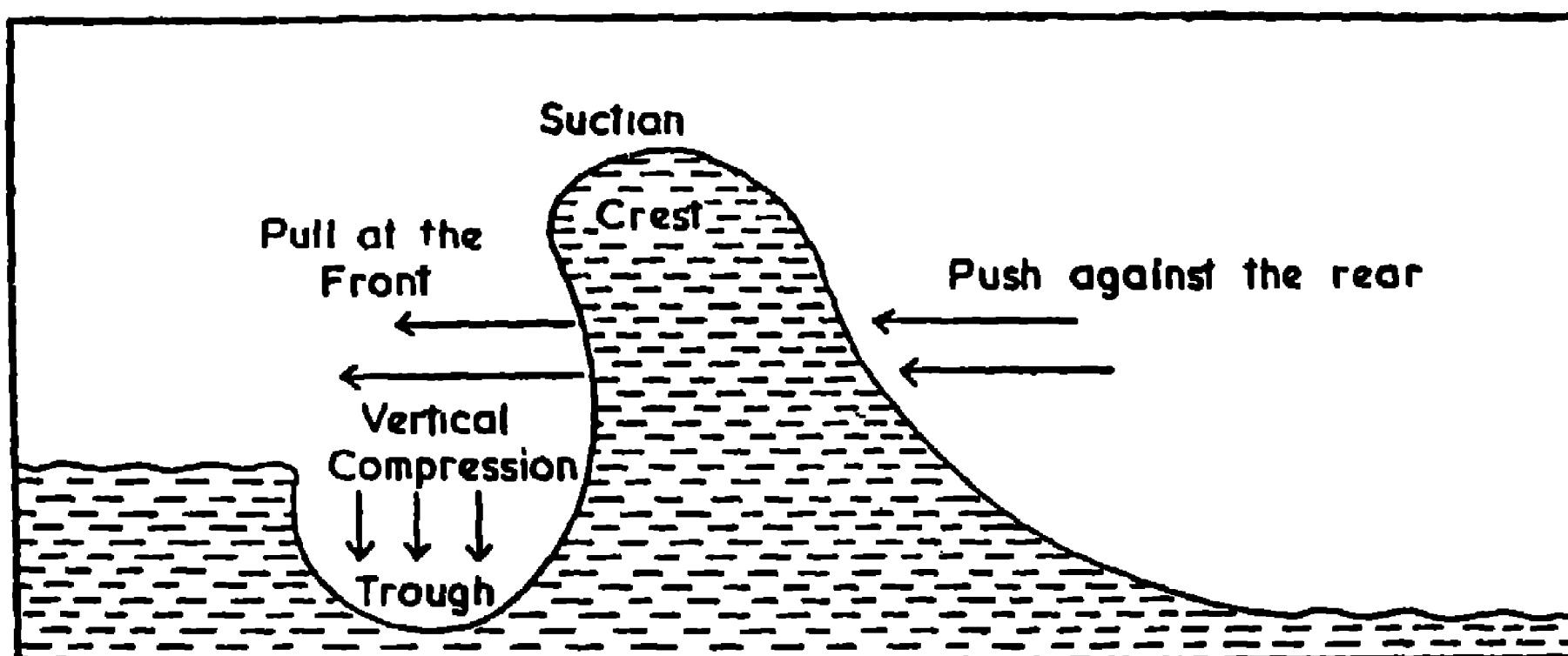


Fig. 3.6: Formation of Wave

Tides

They are the rhythmic rise and fall of the water in the oceans. The sea level forms a smooth curve with

alternating maxima and minima and the character of the surface is wavelike. They are produced by the attraction of moon and sun on the earth. Because the positions of these two heavenly bodies change with reference to the earth, the tides generated are of a complicated character and of different types

1. Spring tide

- 2 Neap tide

These rise and fall of water surface on the ocean occur twice a day each respectively

The natural satellite moon in the solar family is responsible for the tides. The gravitational force of moon is $1/6$ th of the earth's. Since the earth is a solid surface there is no effect to the moon's gravitational force on the land. But it has its effect on the ocean surface. The actual disturbance experienced is the rise of water surface at one area and lowering of water surface at another.

Spring Tides

These occur during new moon and full moon days only when the sun, moon and earth align in a straight line. This is called spring tide since the gravitational pull of sun and moon are unidirectional and thus the effect of bulging of ocean surface is very high compared to the other days.

Neap Tides

These occur during 1st and 3rd quarter phase of the moon. Since sun and moon are at perpendicular positions from

the earth and the gravitational pull is in two different directions; the resultant effect of bulging of ocean surface is comparatively lesser than that of the spring tide

Current

Sea water is always in motion and responds to any force acting on it. The movement of sea water is observed in two directions.

1. Horizontal and 2 Vertical

In this area we are very particular about the horizontal movement of sea water. Sea water moves in the horizontal direction. The horizontal movement can be observed on the

- a top surface of the sea and also
- b below the top surface of the sea
(i.e. subsurface level)

This horizontal movement occurs on the sea due to the following reasons

- (i) Difference in salinity on sea water at different places.
- (ii) Difference in temperature on sea at different places
- (iii) Planetary winds blowing on the sea surfaces also provides a motive force for the horizontal movement of surface water of the sea

Ocean Current

Definition

The ocean current is the horizontal movement of a mass of sea water, in a fairly defined direction over great

distances, due to the difference in salinity and temperature of sea water and also due to the blowing of winds on the surface of the sea. Ocean currents are of two types

(1) Warm currents

(ii) Cold currents

(1) Warm currents

The mass of sea water that which move horizontally from the regions nearer to the equator on either side of it (i.e. Tropical zone) to the next low zones above the Tropical Zone (i.e. Temperate and Sub-Polar Zones) is called a Warm Current.

(ii) Cold Currents

The mass of sea water that which moves horizontally from the polar and sub-polar regions to the Temperate and Tropical Zones is called Cold current.

Origin and Nature of the Movement of Ocean Currents

The origin and nature of the movement of the ocean currents are related to the following factors. The factors are classified as follows

Sl No	Classification	Factors
1	Factors related to earth's rotation	a. Gravitational force b. Force of deflection
2	Factors originating outside the sea	i. Atmospheric pressure ii. Winds iii. Evaporation iv. Precipitation v. Insolation

Sl No	Classification	Factors
3	Factors originating within the sea	A Pressure gradient B Temperature differences C Salinity D. Density E Melting of ice
4	Factors modifying the coast	1 Seasonal variations 11 Bottom topography of oceans

Ocean Currents due to Planetary Winds

The ocean currents follow the direction of the planetary winds which blow on the surface of the sea and pushes the water in its direction. For inferring this phenomenon of the ocean current following the planetary winds direction, kindly compare the planetary winds diagram in an Atlas keeping along side with you the World Ocean Currents diagram and World Climate region chart. Since the planetary winds are blowing throughout the year the ocean currents are also prevailing over the oceans.

Ocean Current Due to Continental Barrier

Continents that are found across the ocean currents obstruct the flow of currents formed due to planetary winds. Because of the obstruction due to the continents the direction of the flow of current gets changed. Ocean currents are found on the world oceans like Atlantic, Pacific and Indian oceans except the Arctic since this ocean is frozen.

Ocean Current due to Earth's Rotation

Great circular currents move clockwise in the northern hemisphere and counter clockwise in the southern hemisphere. The earth's rotation makes the current flow in this way. The strength of the ocean current changes with seasons.

Effects of Ocean Current

Currents not only flow on the top surface of the oceans but also on the sub-surface levels of the sea. These are caused mainly due to the

- difference in salinity and
- difference in temperature

Currents exert an influence on the climate of the bordering coastal regions. They affect temperature, humidity and precipitation. The currents move continuously and they are never quite the same from year to year. The great surface currents of the ocean carry warm water away from the equator. This water gradually cools when it gets even farther from the equator, it mixes with cold waters from high latitudes. Thus when the current turns toward the equator again, it is a cold current. In some years, a current may change its course, or it may carry less water if the wind is not blowing so hard. Changes in currents may cause the changes in the life of the sea. Fishes that depend upon a current to bring them food may die if the current changes. A change in current may change the temperature of the water so that the fish eggs will not hatch as well. On the other hand, favourable changes in a current may mean

more fish and a good year of fishing for people who catch fish for a living

Undertow Currents. are seaward movements of water.

Rip Currents. are localised streams of seaward returning water

The origin and nature of movement of these currents are related to four sets of factors

- (i) Factors related to earth's rotation (gravitational force and force of deflection
- (ii) Factors originating outside the sea (Atmospheric pressure, precipitation, winds, evaporation and insolation)
- (iii) Factors originating within the sea (pressure gradient, temperature difference, salinity, density and melting of ice)
- (iv) Factors modifying ocean currents (direction and shape of coast, seasonal and bottom topography)

Instructional Objectives

- 1 To differentiate a tide and a wave
- 2 To know when the neap and spring tides occur and the cause for it.
- 3 To know the definition of currents
- 4 To understand the two most important factors that result in the formation of currents.
- 5 To recognise the two types of currents
- 6 To identify the various currents of Pacific, Atlantic and Indian Oceans.

7. To identify the location of the Sargasso Sea

8 To know the speciality of the sea

Concepts

1. Ocean currents are those powerful movements of the ocean that proceed regularly, constantly and in definite directions
- 2 Currents follow the main direction of planetary wind system.
3. Currents tend to flow from area of low salinity to that of high salinity
4. Warm currents flow from low latitudes in tropical zone, towards high latitudes in the temperate and sub-polar regions
- 5 Currents flowing from high latitudes to low latitudes are cold currents
6. Pacific Ocean currents - North Equatorial current - Kuroshio Current - North Pacific current - British Colombian current - California Current - Oyashio current - Ohhoyd current

Atlantic Ocean Currents

North equatorial current - south equatorial current - Florida current - Gulf stream - North Atlantic drift - Norwegian current - Cold Canaries current - Labrador current - Warm Brazil current - Cold Benguela current

Indian Ocean Currents

North and South equatorial currents - counter equatorial current - Mozambique warm current - Agulhal current - West wind drift - West Australian current.

- 7 Sargasso sea is located in the center of the North Atlantic Ocean on the horse latitude, which is devoid of strong winds. Gold coloured sea weed-sargassum floats in abundance here. But for the weed, this sea is a biological desert.

Development

a. Waves and Tides

- (i) Take a glass trough of water and lay it on the table. To one side (left or right) of the trough keep a fan so that air straight away hits the surface top of the water in the trough from one end. Now switch on the fan and ask the students to observe the change in surface of the water, through either sides of the glass trough. Ask them about the observed change. Thus they can identify wave formation. Next, show them the waveform diagram and explain the crest and trough and wavelength.
- (ii) Now remove the fan and bring a vacuum cleaner or a suction pump and pose the hose end just above the surface of water and switch on the suction switch. Now ask the students to observe the change on the surface of water. Put off switch after observation. While doing this experiment the students should be reminded to imagine this trough of water is the ocean on earth and the suction pump as the moon and sun on a line.

This activity shows that the bulging of water takes place. Explain that the gravitational force of moon and sun act on a same line.

B. Neap and Spring Tides

- (1) Repeat the suction pump experiment again by taking two vacuum cleaner pipes focussed towards the surface of water in a straight line at two heights. Stick labels SUN and MOON on the hoses to indicate clearly. Also stick a label on the side of trough with the name of any ocean on earth. Now do the experiment and ask the students to observe the change in the bulging while comparing to the previous one. Now explain the spring tide.
- (11) Alter the position of the two hoses perpendicularly and repeat the experiment. Ask the students to observe and explain neap tide.

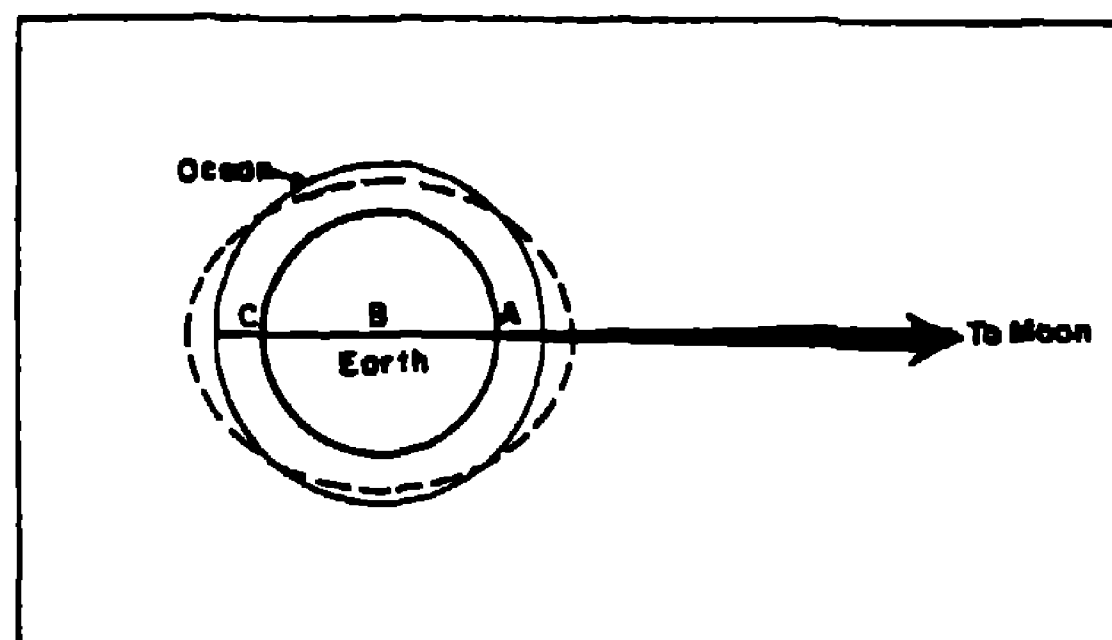


Fig. 3.7a: Formation of Tides

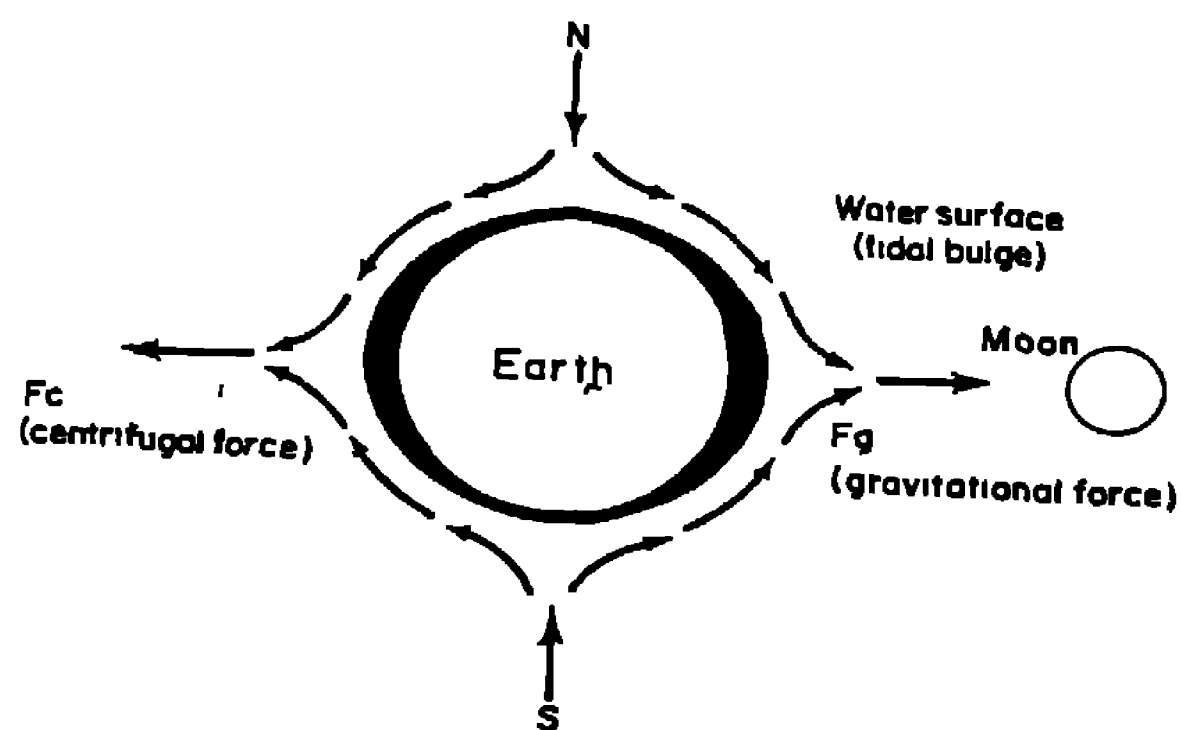


Fig. 3.7b: Tides due to Gravitational and Centrifugal Forces

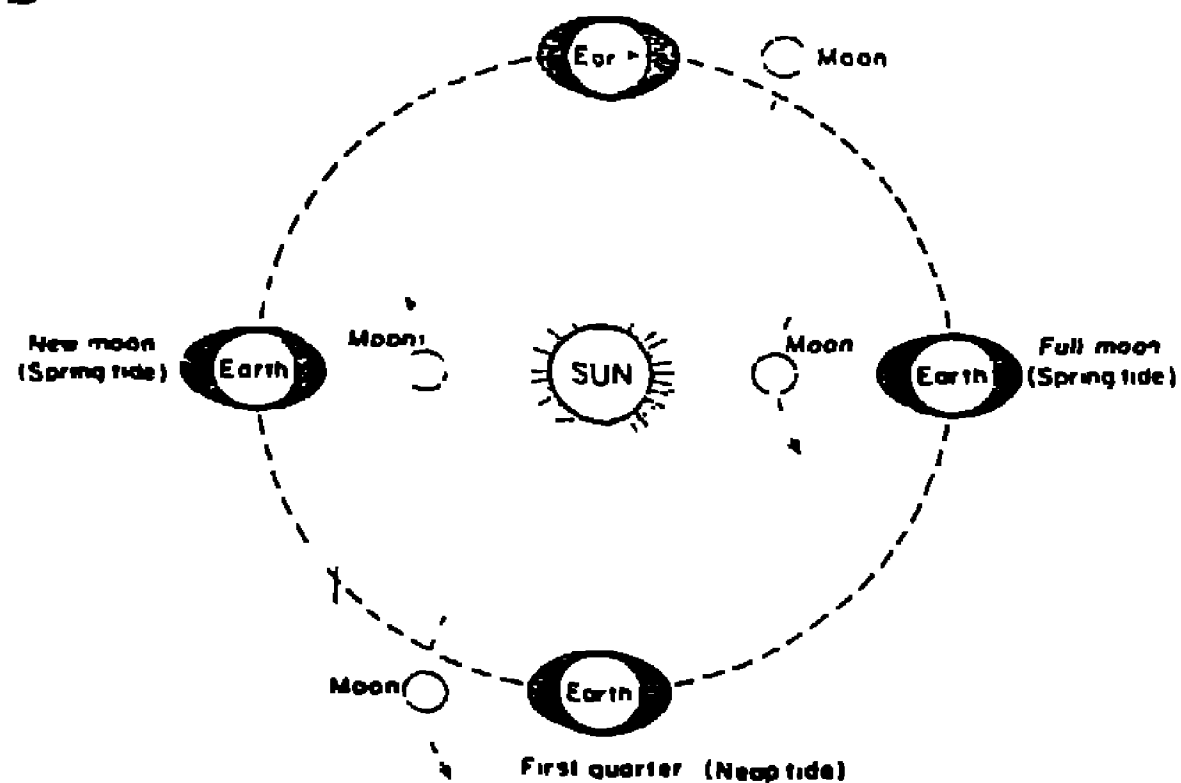


Fig. 3.7c: Neap Tides and Spring Tides

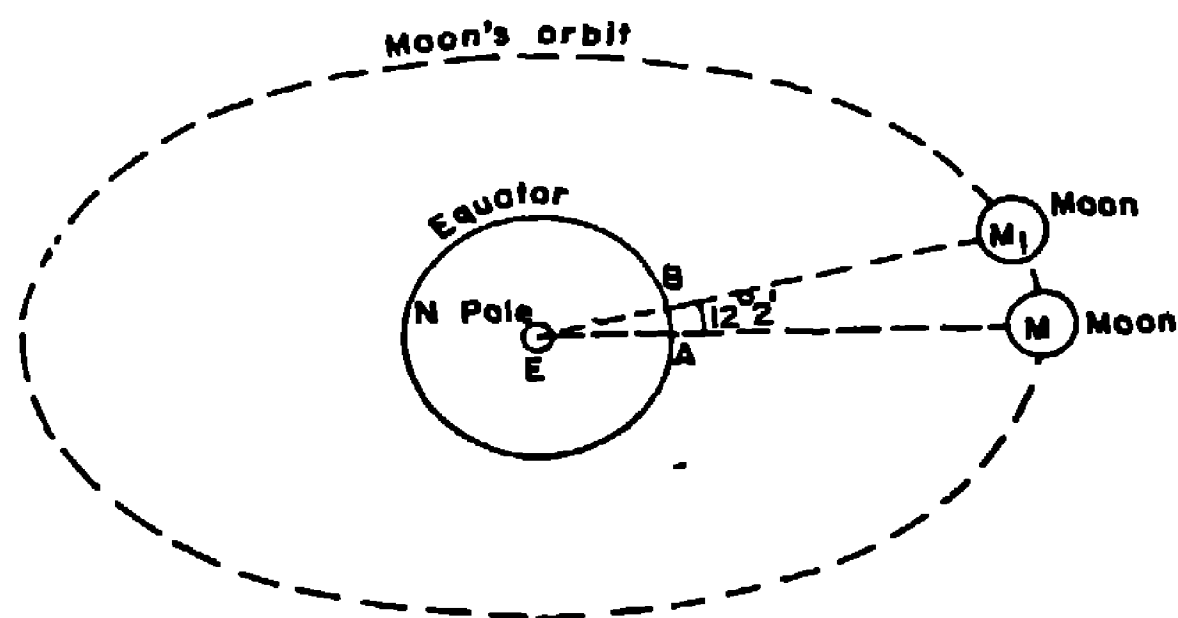


Fig. 3.7d: The Moon's Revolution and the Interval of Tides

C. Currents

Activity 1

Display a world map, arrow marked on it with Atlantic Ocean Currents in the classroom.

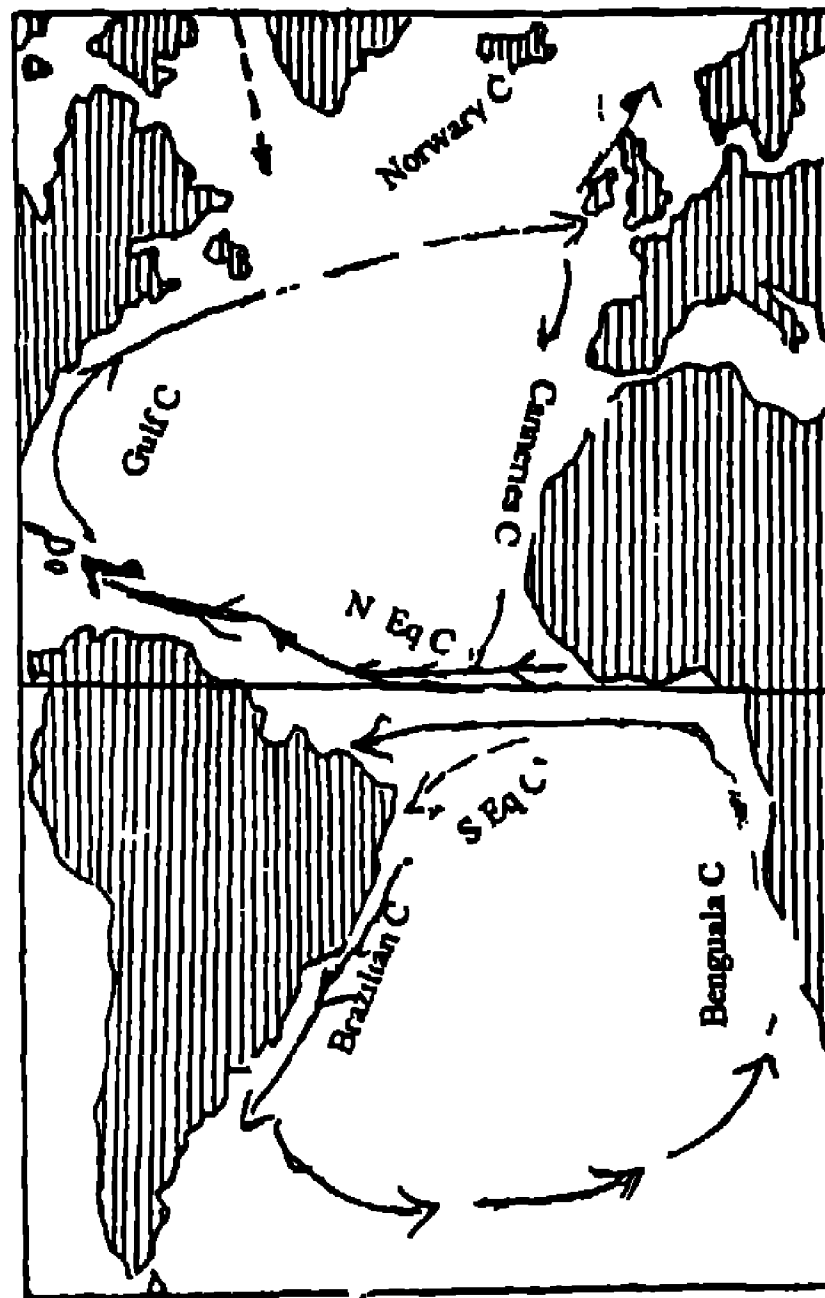


Fig. 3.8: Currents in Atlantic Ocean

Provide the participants with world outline map stuck on a thin card board in the ratio of 1 map/2 participants. Display several charts with diagram depicting the planetary winds, world climatic regions found in the Atlas near each group. Now provide the graphs with one small magnet piece and paper arrows stuck up on ball head pins. The teacher educator now should ask the participants to observe the Atlantic Ocean Current chart and then arrange the arrows provided to him on the World Outline Map on the appropriate ocean. Then with the help of the magnet placed underneath

the map ask them to trace the direction of the Atlantic Ocean Current. After doing this they should be asked to trace the North Atlantic Ocean current and South Atlantic Ocean Current in their respective maps with a red colour pencil/sketch, and write the name of the current

Finally they should be asked to compare the world planetary wind chart and world climatic regions chart for the planetary winds and their directions prevailing on those regions with respect to latitude degrees, north and southern hemisphere directions and also clockwise or anti-clockwise movement and climatic region. At last the teacher participants should be asked to recall the causes of the current

- a. Temperature at the equatorial region
- b. Planetary wind and its direction in that region
- c. The continental barriers on the four directions of the Atlantic Ocean

and then suitable explanations to be given

Activity 2

Prepare a projected 2D model of the continents on the globe and paste them on a flat solid water proof base in their respective positions leaving proper space for sea and oceans. Raise and close the solid base's periphery, so that when water poured for the oceans, will not flow out.

10°N and 10°S latitudes on both sides of the equator should be projected high so that it becomes similar to a catchment area. Tie flap stating this area is the equatorial or hot region.

Now pour very hot water with potassium permanganate in the equatorial catchment area. Pour very chill water in the rest of the ocean areas up to the brink level of the 2D objects (continents). Place a small pedestial fan on the western side in a 45° angle, so that when switched on the air flows on the surface of the ocean from West to East Put on the fan Ask the participants to observe the flow of water mass on the surface Then make holes on the sides of the 10°N and 10°S latitudes by using a long, thin and sharp ended iron rod Now ask the students to observe the colour water oozing out of the equatorial region in the form of currents and their movement in the direction of the wind, flowing form the fan and also the change in direction of colourful water mass due to land mass (continental) obstruction This experiment has to be done separately for various currents.

Activity 3: Convection Currents

Purpose

To simulate the movement of ocean currents due to convection (the movement of heat through gases and liquids)

Materials

- 4 to 5 ice cubes
- 2 1-quart (1-liter) large-mouth jars
- cold tap water
- baby food jar
- warm tap water
- spoon

green food colouring

4-inch (10-cm) square of aluminium foil

rubber band

pencil

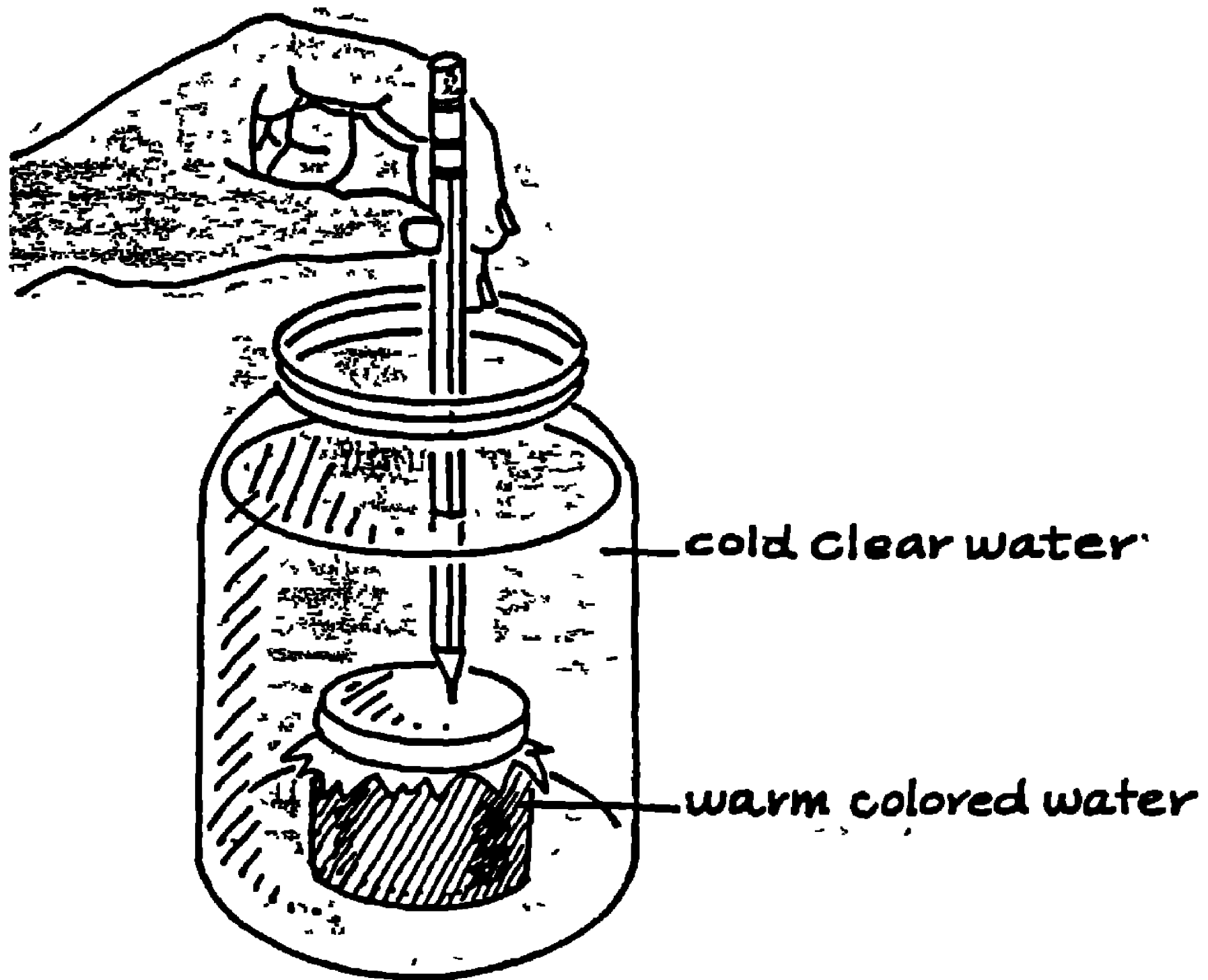
timer

Procedure

- 1 Place the ice cubes in one of the jars Fill the jar with the cold water
- 2 Fill the baby food jar to overflowing with the warm water Stir in 10 drops of the food colouring
- 3 Cover the mouth of the baby food jar with the foil and secure it with the rubberband
- 4 Stand the baby food jar inside the second quart (liter) jar
- 5 Remove the unmelted ice cubes from the first jar and pour the chilled water into the second jar, filling it three-fourths full.
- 6 Use the point of the pencil to make one small hole slightly off center in the foil
- 7 From the side, observe the contents of the jar for about five seconds.
- 8 Make a second hole in the foil
- 9 Observe the contents again.
- 10 Continue to observe the contents every five minutes for 20 minutes.

Results

Nothing happens with only one hole in the aluminium foil, but with two holes a stream of green water rises and



moves along the surface of the cold water. After a while, the streams of green water start sinking.

Why ?

Water molecules, like air or any form of matter, are closer together when cold and farther apart when hot. Thus, the clear cold water weighs more than the coloured warm water because its molecules are more densely packed together. When there is only one hole in the foil, the lighter warm water is prevented from rising because of the pressure of the heavier cold water above it. The cold water cannot enter through the hole in the foil because the baby food jar is filled with water. Adding a second hole allows the cold water to sink into the jar, pushing out of its way the warm water, which rises to the top. This rising and sinking movement of liquids or gases due to differences in temperature is called Convection Currents. Ocean currents move around the earth as the warm water near the equator flows up and down toward the poles. The cold polar water sinks and flows down toward the equator.

D. Sargasso Sea

Provide an Atlantic Ocean currents map where the names of all seas are marked along with latitudes also. Ask the students to list out the various seas on the ocean in separate paper. Then ask them to point out the Sargasso sea on it, after pointing out the same, provide them the flash card stating Sargasso sea on one side with the picture of the weed stuck and its speciality on the other side. Ask every-one to read and note down the information. Then

narrate the history behind the latest scientific exploration information about that place as a biological country. On doing this the students can locate Sargasso Sea and the reason for the name and also the history and speciality of the place.

Evaluation

- 1 Differentiate a tide and a wave
- 2 List the type of tides and their causes
3. Define in a current, list the most important causative factors of current formation.
- 4 Provide a world's ocean currents map marked without the current's name and ask the students to mark the following currents
 - California current
 - Norwegian current
 - Agulhas current
 - Mozambique warm current
- 5 State the reason for the name of the sea as Sargasso Sea and what is the nick name to that sea given by marine explorers ?
6. Provide a world distribution of salinity map to the participants and ask them to locate high saline areas and very low saline areas. Also ask them to reason out why the difference.
- 7 What are the causes for rise of temperature of ocean surface ?
- 8 Explain the process of temperature rise of ocean surface due to radiation.
9. What are the reasons for variation in temperature of ocean surface ?

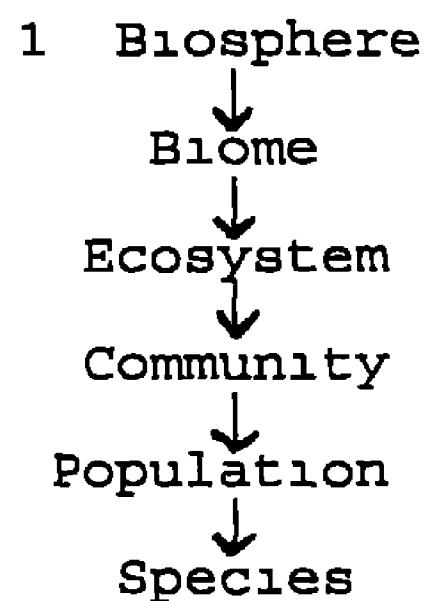
BIOSPHERE

BIOSPHERE

Introduction

Living organisms are inseparably related with their physical and biological surroundings. This inter-relationship of earth and the biotic community together is known as "Biosphere". To Earnest Haeckel it is the study of the reciprocal relationships between organisms and environment. Eugene P. Odum defined it as "Ecology".

Biosphere as a system encompasses many levels of organisations in which there are several units. These units are arranged in an ascending order.



Instructional Objectives

- 1 Species A group of specific individuals plant or animals
- 2 Population A local group (deme) of individual species of an ecological region or geographical region or ecological niche. It can be plant/animal/human population
- 3 Community. Community has many populations interacting with each other. Such community of different population of organisms is called as a biotic community

- 4 Ecosystem The biotic community of a region (geographical) and also the non-living abiotic components of the region like light, water, soil components, temperature, atmosphere, and water interact with each other to form a stable ecological unit called ecosystem. It will vary according to the geographical variations like pond, lake, forest, desert, grass land and ocean. The term ecosystem was coined by A. G. Tansley.
- 5 Biome A large natural geographical area like tropical forest or arctic biome. A biome contains more ecosystems.
- 6 Biosphere It includes all parts of earth that support and contain living organisms.

Instructional Objectives

- 1 To discriminate between the biotic and abiotic components of the environment.
- 2 To recognise the important elements of the environment.
- 3 To find the inter-relationship between various units of the biosphere.
- 4 To describe the features of ecosystem and biome.
- 5 To identify different types of biomes.
- 6 To define atmosphere.
- 7 To draw the diagram indicating the layers of atmosphere.
8. To distinguish between stratosphere and troposphere.
9. To identify the layers of the structure of earth.
- 10 To describe the formation of different types of rocks.
11. To distinguish between igneous and sedimentary rocks.
- 12 To find the relationship between hydrosphere and atmosphere.

- 13 To draw the diagram of water cycle indicating the important processes.
- 14 To identify various hydrological biomes
- 15 To generalise the totality of all the atmosphere, hydrosphere and lithosphere with biosphere
- 16 To create awareness about conservation and protection of biotic components of the environment and biosphere

The biosphere encompasses all parts of the earth which can support and which contains life. Biosphere mainly consists of lithosphere (made of soil), hydrosphere (made of water), and atmosphere (made of air). Biosphere and its units like many biomes provide the different types of habitats for the evolution of organisms. Organisms are totally dependent upon their "environment" for their subsistence and are inseparably related to it, thus the relation that exists between the organisms and the environment is reciprocal nature.

In a way we can say that biosphere is a conglomeration (collection of numerous biomes). The environment includes both physical and or non-living (abiotic), and living or biotic environment. Abiotic environment includes the soil, and atmosphere (climate) precisely.

Development of Concepts in Biosphere

Teachers are expected to list the following, as biosphere can be studied as a combination of both abiotic and biotic factors.

1. Physical (abiotic) factors

The main factors are soil, climate and medium

Medium

The different media that support biological life on the earth are soil, water, air and the bodies of other organisms as in the case of parasites.

Climate

Climate is the average of the atmosphere over a given area. The main climatic factors are temperature, humidity, light, wind, rainfall and snow.

Chemical factors

Chemical factors like gases, oxygen, carbondioxide and oxygen ion concentration, i.e. pH, hydrogen sulphide and nutrients are important in abiotic environment.

Concepts

Environment literally means the surroundings of an object. For example, the environment of that plant, refers to the conditions which favour the growth of a particular plant. While the environmental conditions in Punjab are suitable for the cultivation of wheat, the conditions in Cauvery delta in Tamilnadu and Karnataka are not suitable for the cultivation of wheat. Thus the environmental conditions vary from place to place.

- * Our immediate concern is the environment in which man lives. Earth is the habitat of man.
- * Human beings do not live in isolation from other life forms on earth as he depends on them for his "food" and

other necessities Thus the study of the environment must cover all forms of life on the earth.

- * Types of soils and soil formation is a process known as pedogenesis.
- * Earth is a unique planet in the solar system as it has favourable environmental conditions for different life forms.
- * The air which surrounds the earth contains "oxygen" which is essential for all forms of life
- * The air which envelopes the earth also moderates the temperature between day and night and between summer and winter.
- * The moderate temperature conditions enable water to be present in large quantities on the earth That is how "hydrosphere" exists on earth
- * The presence of water favours growth and evolution of various species of plants and animal life, including human beings. Thus the earth is unique in having life-bearing layer or "Biosphere"
- * The types of plants and animals living in a particular region depends on the physical environment prevalent in that region Thus the environment in which human-beings live consists of both biological and non-living environment
- * The physical environment comprises land, water and air. While the biological environment interacts with plants and animals and other organisms.

The physical and biological environments are interdependent and interact with one another. A change in physical environment brings about a corresponding change in biological environment

Habitat ecology

It deals with the study of numerous and different types terrestrial habitats like forests, grasslands and deserts.

Community ecology

It deals with the study of the composition of different organisms and how they depend on one another or interact with one another

Population ecology

It deals with the growth rate and structure of populations of different organisms of the community

Species ecology

It is concerned with specific organisms and their environmental requirements in an ecological zone or area. It is the last or the ultimate unit of an ecosystem, where the "ecological niche" formation takes place which can be said to be the "micro climatic condition" which supports species growth and development.

Pedology

The branch of ecology which deals with the study of soil formation, the nature of different types of soil like acidic, and alkaline and how such soils can be modified to encourage growth of plants and animals on earth is called pedology.

Development of Ecosystem

When we refer to ecosystem we must surely consider the planet earth to be an ecosystem, since ecosystem means the "structural and functional unit of nature" or it can be said as a system of living organisms and their environment which interacts with one another and exchange materials" The term ecosystem was coined by A G Tansley (1935)

Ecosystem can be broadly classified into two types
(a) Terrestrial ecosystem and (b) Aquatic ecosystem

a. Terrestrial ecosystem

This can also be called land ecosystem This ecosystem is represented by deserts, grasslands and forest ecosystems. The forest ecosystems are classified as temperate, sub-tropical or tropical forests depending upon their geographical location.

b. Aquatic ecosystem

They are classified into fresh water or limnetic ecosystem and salt water or marine ecosystem The limnetic ecosystem is further classified into two types: (a) Lentic and (b) Lotic

a. Lentic ecosystem

It is a type of limnetic ecosystem where the water is stationary as in pond or lake ecosystem.

b. Lotic ecosystem

In this type of limnetic ecosystem the fresh water flows as in river ecosystem

c. Marine ecosystem

The sea or salt water or marine ecosystem covers two-thirds of the earth's surface. This ecosystem is represented by the seas, oceans, coral reefs and the estuaries (estuarine ecosystem is a subsystem of the marine ecosystem)

The estuarine ecosystem is one of the most productive ecosystems. It is rich in biodiversity

The intimate or close relationship between structure and function is clearly seen in an ecosystem. With reference to structure, an ecosystem has two major interacting components: (a) Abiotic and (b) Biotic.

a. Abiotic component

This is also referred to as the non-living component. It includes the energy of sunlight, which is so essential for the maintenance of an ecosystem. Inorganic components like SO_4 , NO_3 , PO_4 , Ca, K, Na, Mg are all abiotic components. Even climatic factors like temperature and water are also important abiotic components of an ecosystem.

b. Biotic component

As the term suggests, this is the living component composed of organisms both microscopic and macroscopic. The two major groups of biotic components are plants and animals. These biotic components have many levels and each level is referred to as the "trophic" (nutritional) level.

Ecosystem

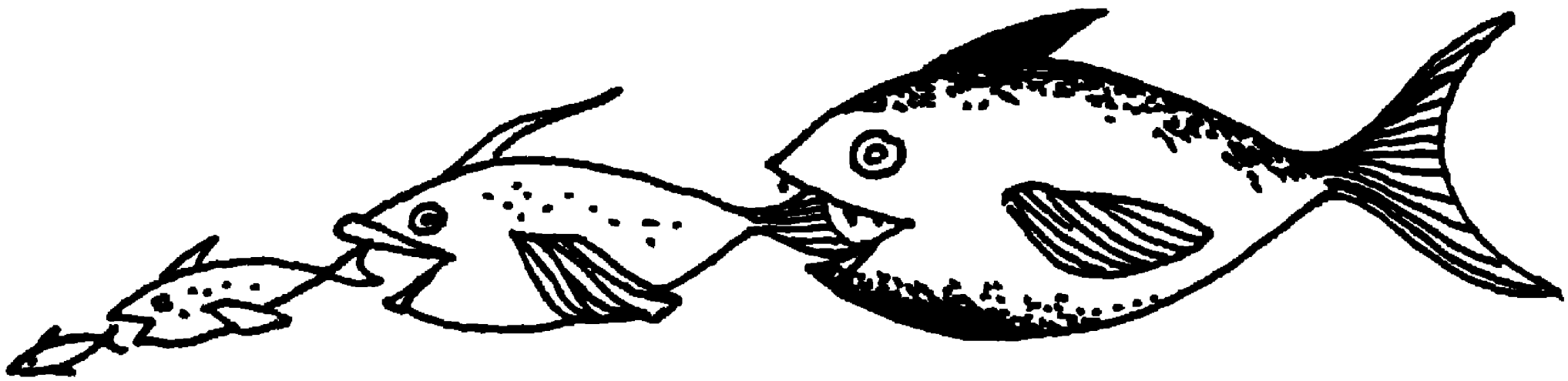


Fig. 4.1: The phenomenon of "eating and being eaten"

As already stated, nature consists of two major components, the living organisms and environment. The living organisms of an area on the earth are under the influence of many external factors (light, temperature, water, gases, etc.) These external factors constitute the physical environment. The organisms and environment are inseparable and interact with each other. They exist in a state of dynamic equilibrium

A G Tansley (1935) coined the term ecosystem. Even before Tansley, different terms were introduced to explain the concept of ecosystem. They are

<u>biocoenosis</u>	- Karl Mobius
<u>microcosm</u>	- S.A. Forbes
<u>geobiocoenosis</u>	- Sukachev
<u>holocoen</u>	- Friederichs
<u>bioinert body</u>	- Vernadsky

Definition

Ecosystem may be defined as "the structural and functional unit of nature"

or

"It is a system of living organisms and their environment which interact with one another and exchange materials".

Components of Ecosystem

Every ecosystem has both a structure and a function. The structural component includes all the living organisms and their interrelationships. The functional component includes the exchange of materials, energy flow, nutrient cycling, etc.

Ecosystem has two major components namely, 1 Abiotic (non-living) component and 2 Biotic (living) component

1 Abiotic Component

This non-living component of an ecosystem consists of (a) materials and (b) energy

(a) Materials

There are different kinds of inorganic and organic materials in the environment. The inorganic materials include mineral substances, water, air, etc. The total amount of these inorganic substances present in an ecosystem is called standing state. The organic materials include proteins, carbohydrates, lipids, etc. which are derived from the dead bodies of plants and animals. The organic materials are ultimately converted into simple mineral substances.

Living organisms take these materials from the environment. After the death and decomposition of the organisms, these materials once again flow back into the environment. Such a flow of materials between the organisms and their environment is called biogeochemical cycle or mineral cycling.

Eg Water cycle, carbon cycle, nitrogen cycle (gaseous cycles), phosphorous cycle (sedimentary cycle)

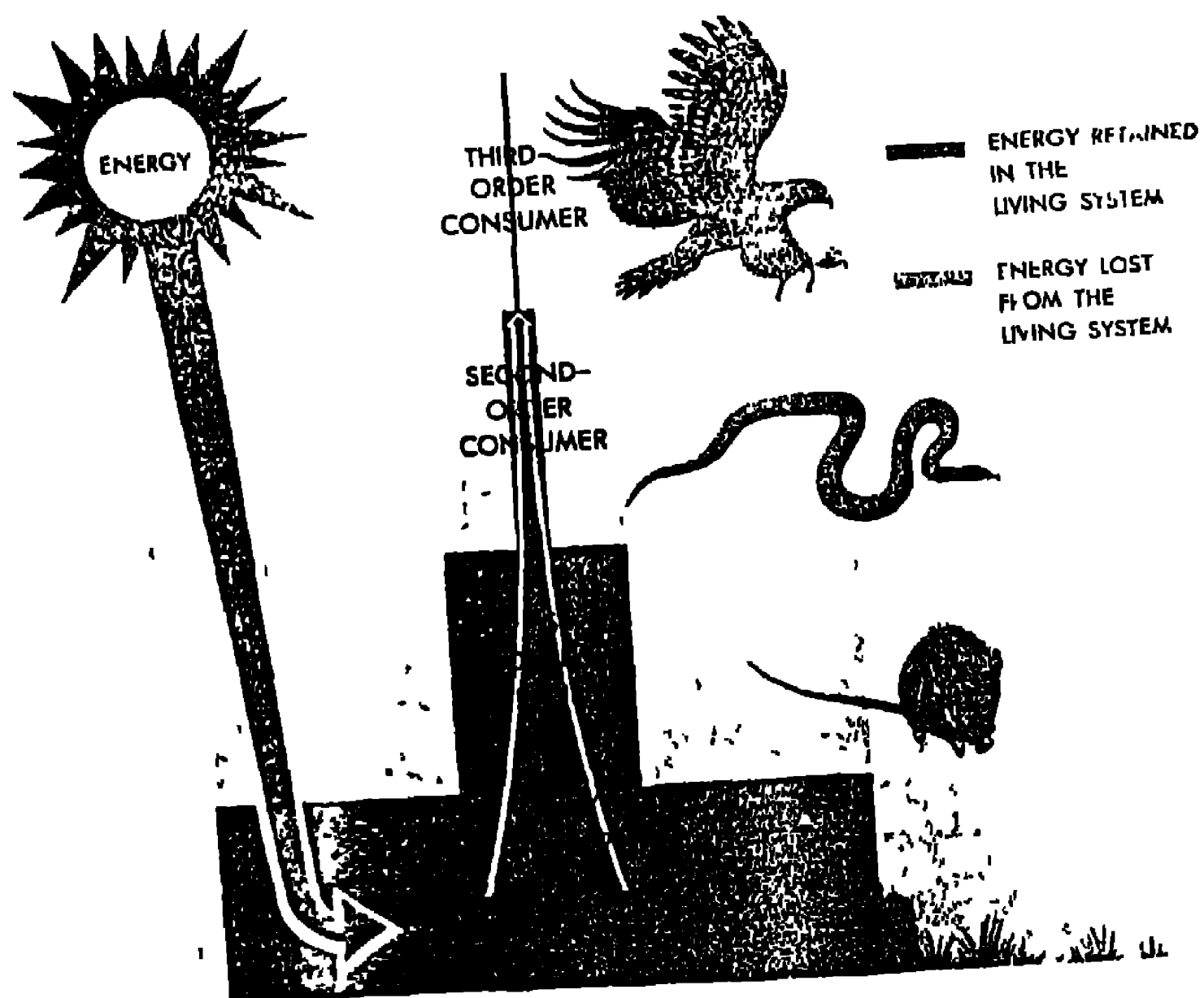


Fig. 4.2: Energy Flow Through Different Biotic Components of Ecosystem

(b) Energy

The ultimate source of energy for the entire ecosystem is the Sun. In an ecosystem, energy exists in different forms. One form of energy is converted into another form.

For example, green plants absorb the radiant energy and convert it into chemical energy (ATP) which is finally converted to potential energy (energy-rich food materials). Heat energy is liberated during the respiration of living organisms.

The amount of energy flowing through an ecosystem gradually diminishes. The flow of energy in an ecosystem is always unidirectional.

Energy Flow in an Ecosystem

Energy is captured in plants and is stored as chemical energy in the producers. This energy stored in the plants is passed along through the ecosystem in a series of steps of eating and being eaten, which constitute the food chain in the ecosystem. A food chain consists of producers, primary consumers, secondary consumers, tertiary consumers, etc. Energy flows from producers to consumers. At each transfer 80 to 90% of the energy is lost as heat produced during the process of respiration and others. Only 10% is transferred to the next level.

The energetics of ecosystems are mainly

- 1 Quantity of solar energy reaching an ecosystem
- 2 Quantity of energy used by green plants in the process of photosynthesis
- 3 The quantity and path of energy flow from producers to consumers.

In the earth's atmosphere about 15×10^8 calories in $\text{m}^{-2} \text{Yr}^{-1}$ of solar energy is received. 34% of solar radiations

reaching the earth's atmosphere is reflected back in space by clouds and dust, 9% is held by ozone, water vapour and other gases 10% is absorbed by clouds Remaining 47% reaches earth's surface 1 to 5% of the energy reaching the ground is converted by green plants to chemical energy and 42 to 46% is absorbed as heat by ground, vegetation or water

Figure 4 2 represents a very simplified energy flow model of the three trophic levels The boxes represent the population mass or biomass and the pipes depict the flow of energy between the living units Of the 3000 KCal of total light falling on the green plants, 50% (1500 KCal) is absorbed of which 1% (15 KCal) is converted at the first trophic level The herbivore feeding upon producers stores in its body only 1.5 KCal (10%) and the carnivore feeding upon the herbivore conserves 0.15 KCal (10%). So all the energy available in a trophic level is not consumed but a good portion of it is left unutilised (NU) Of the food ingested, a part is excreted out (NA) So the energy flow along different trophic levels, follows an average 10% rule, i.e. only 10% is stored in successive higher trophic level. At each transfer a major part is lost as heat in the metabolic activity of an organism (R) Thus there is a gradual reduction in energy flow at successive trophic levels. Shorter the food chain greater would be the available food energy Longer the food chain, more is the loss of energy

- * Density of air decreases with altitude
 - * Pressure drops from 1 atmosphere at sea level at 3×10^{-7} atmosphere at 100 km altitude
 - * Temperature varies from -100°C to 1200°C .
 - * The total mass of atmosphere 5×10^{15} tonnes
- (Fig 4.3)

The World Health Organisation (WHO) has defined air pollution as "the presence of materials in the air in such concentrations which are harmful to man and his environment"

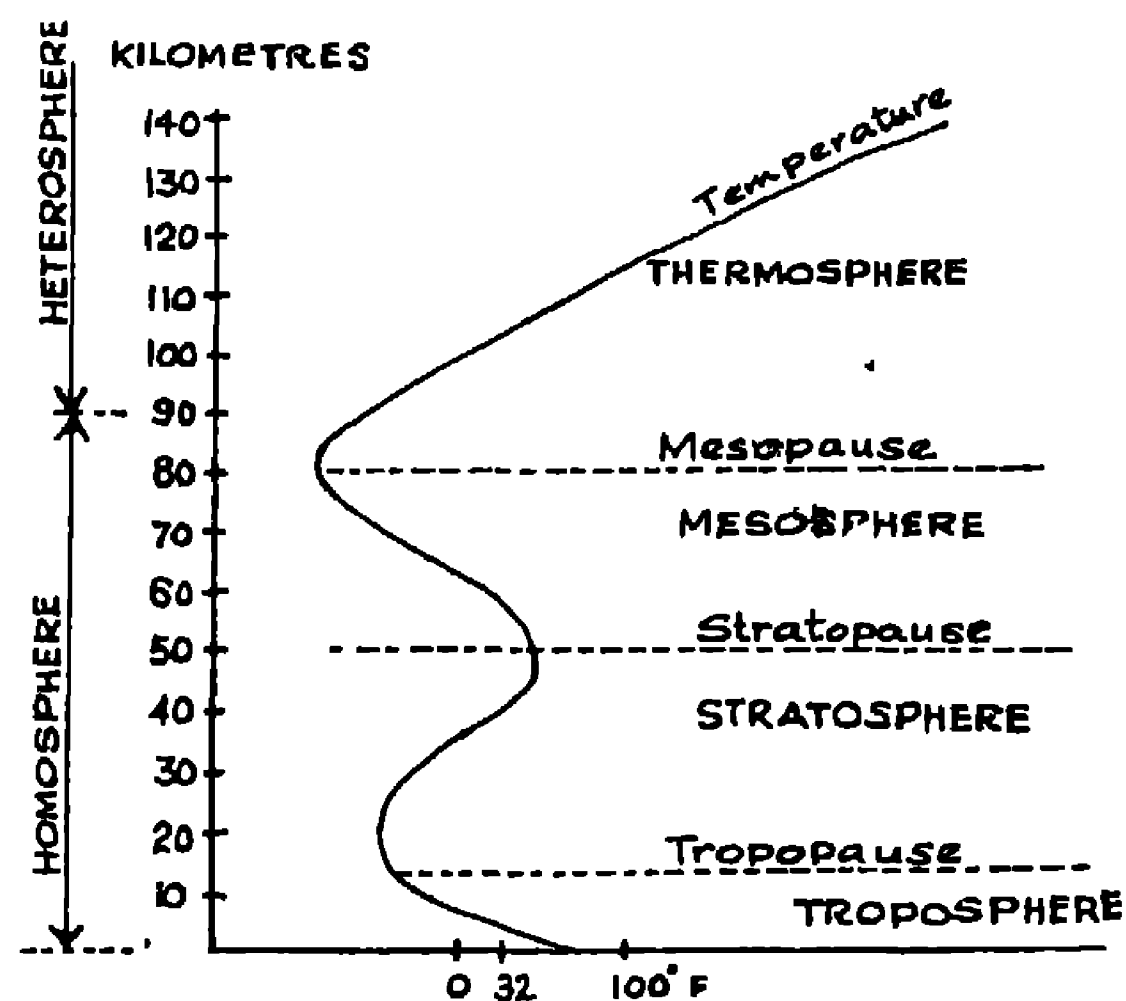


Fig. 4.3: A Layered Structure of the Earth's Atmosphere
Air pollutants

The air pollutants are broadly classified into primary pollutants and secondary pollutants.

1. Primary pollutants

These are the pollutants emitted directly from identifiable sources.

- (i) Sulphur compounds SO_2 , SO_3 , H_2S and mercaptans produced by the oxidation of fuel
- (ii) Carbon compounds CO , CO_2 and hydrocarbons
- (iii) Nitrogen compounds NO , NO_2 , NH_3
- (iv) Halogen compounds: HF (Hydrogen fluoride), HCl
- (v) Particles: Particles of varying diameters.

11. Secondary pollutants

These are produced by the reactions of primary pollutants in the atmosphere.

Effects

- 1 Dust and smoke particles cause irritation of respiratory tract and produce bronchitis, asthma, etc
- 2 Smog is a dark and opaque form which is formed by the dust and smoke particles causing condensation of water vapour found in them. Chemicals like SO_2 , H_2S , NO_2 also go into the smog
 - * Smogs cause necrosis, silvering and glazing in plants
 - * Causes respiratory problems in human beings
 - * Reduces the visibility
- 3 Particulate matter scatters in the air and absorbs the light
- 4 Cotton fibres in the air causes pneumoconiosis or lung fibrosis called byssinosis.
- 5 Asbestos particles cause asbestosis in the lungs

- 6 Silica particles cause silicosis.
- 7 Iron particles cause siderosis.
- 8 Carbon particles cause black lung

Aerosols

These are the chemicals which are present in the air in the form of vapours or fine mist. These are emitted from jet aeroplanes and contain chlorofluorocarbons (CFC compounds). Burning of plastic produces polychlorinated biphenyls (PCB). Chlorofluorocarbons cause ozone depletion in atmosphere (Fig. 4.4)

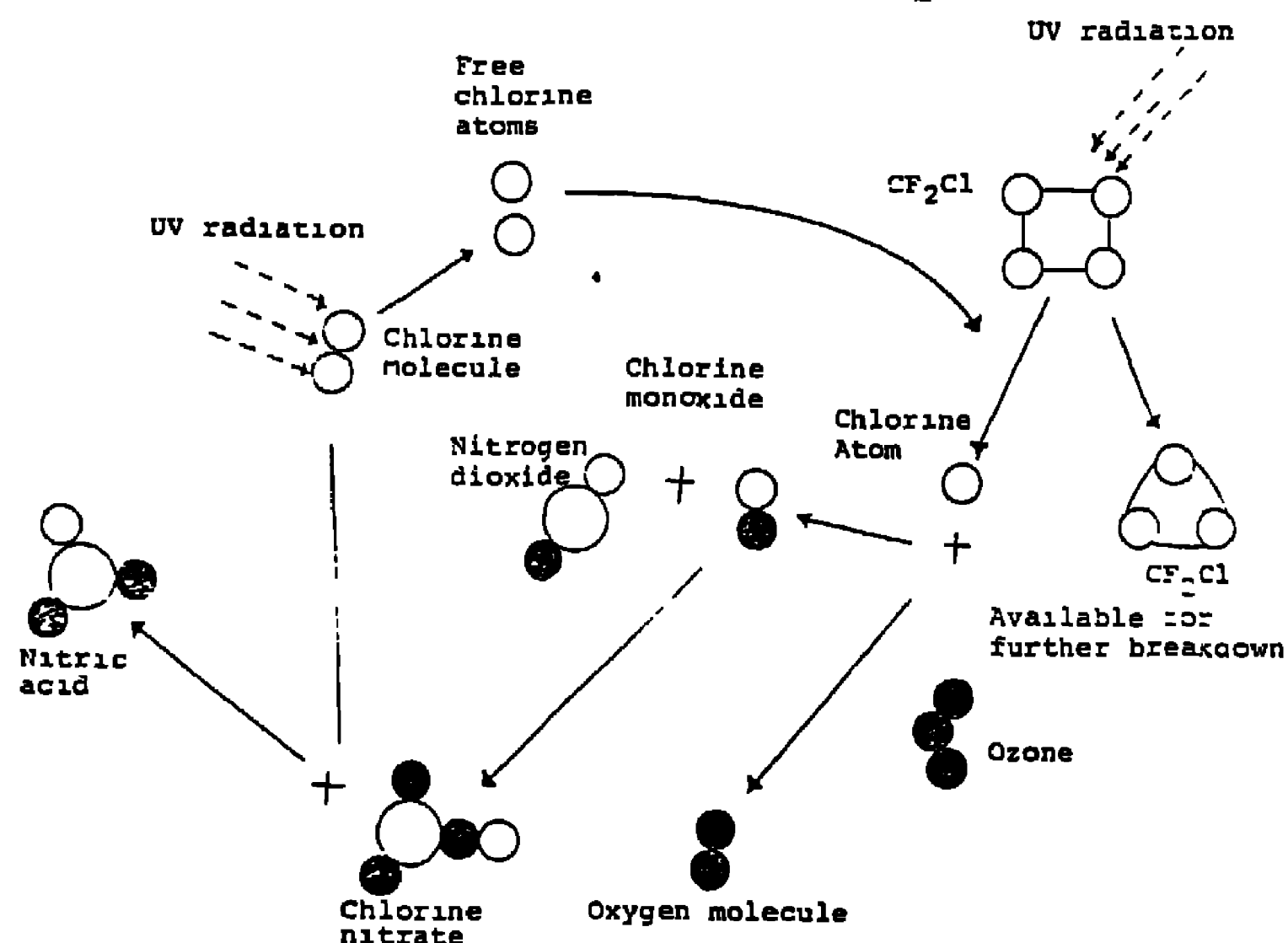
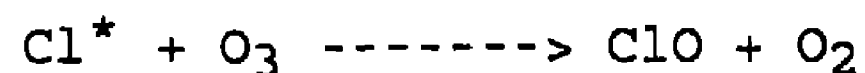
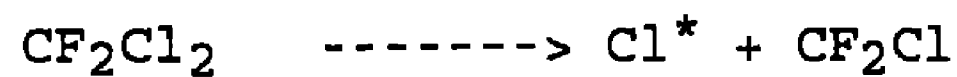


Fig. 4.4: A Simple Version of Stratospheric O_3 Depletion by the Temperature

- 1 Pollution is a major factor the earth now facing from various sources like industrial wastes, which contain

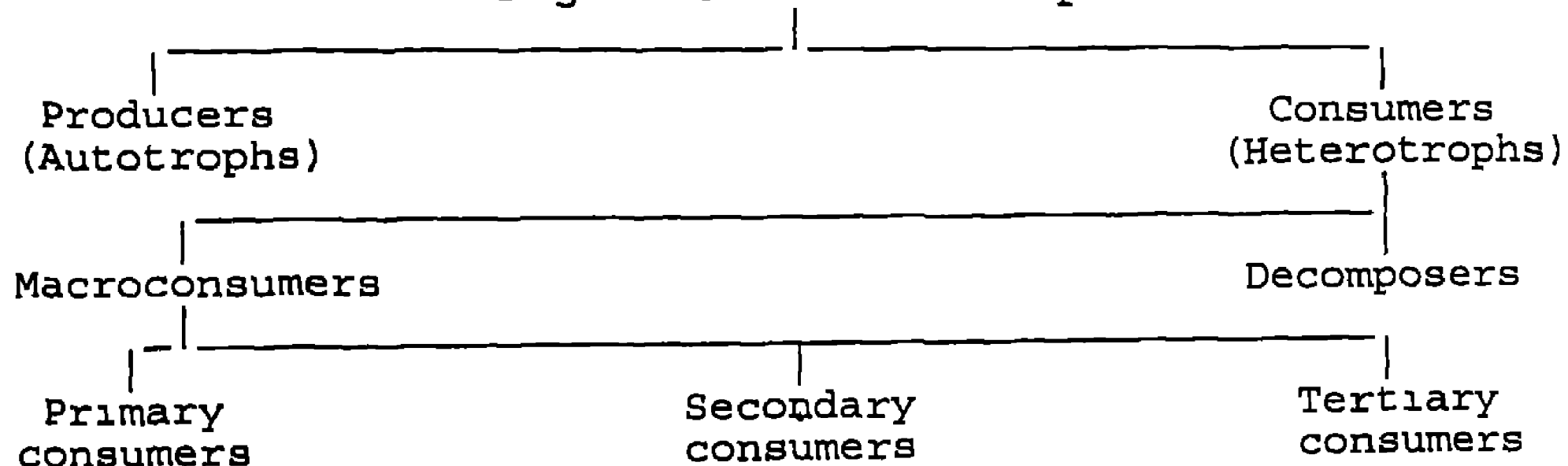
toxic agents like metal salts and complex synthetic chemicals

- 2 Agricultural wastes, which comprises of fertilisers, pesticides and biocides
- 3 Physical pollutants like heat thermal pollution and radioactive substances.

2. Biotic component

All the living organisms of an ecosystem constitute the biotic component. This biotic component is further classified as follows depending on their nutritional (trophic) relationships.

Fig. 4.5: Biotic Component



A. Producers

All autotrophic organisms which prepare organic food materials are called producers. Producers synthesize complex, energy-rich food materials by photosynthesis. Photosynthetic organisms convert the solar energy into chemical energy. Hence producers are also called converters or transducers. Producers are the primary source of food material for all consumers in an ecosystem. Food chain begins with producers.

Eg. Green plants, photosynthetic bacteria, chemosynthetic bacteria.

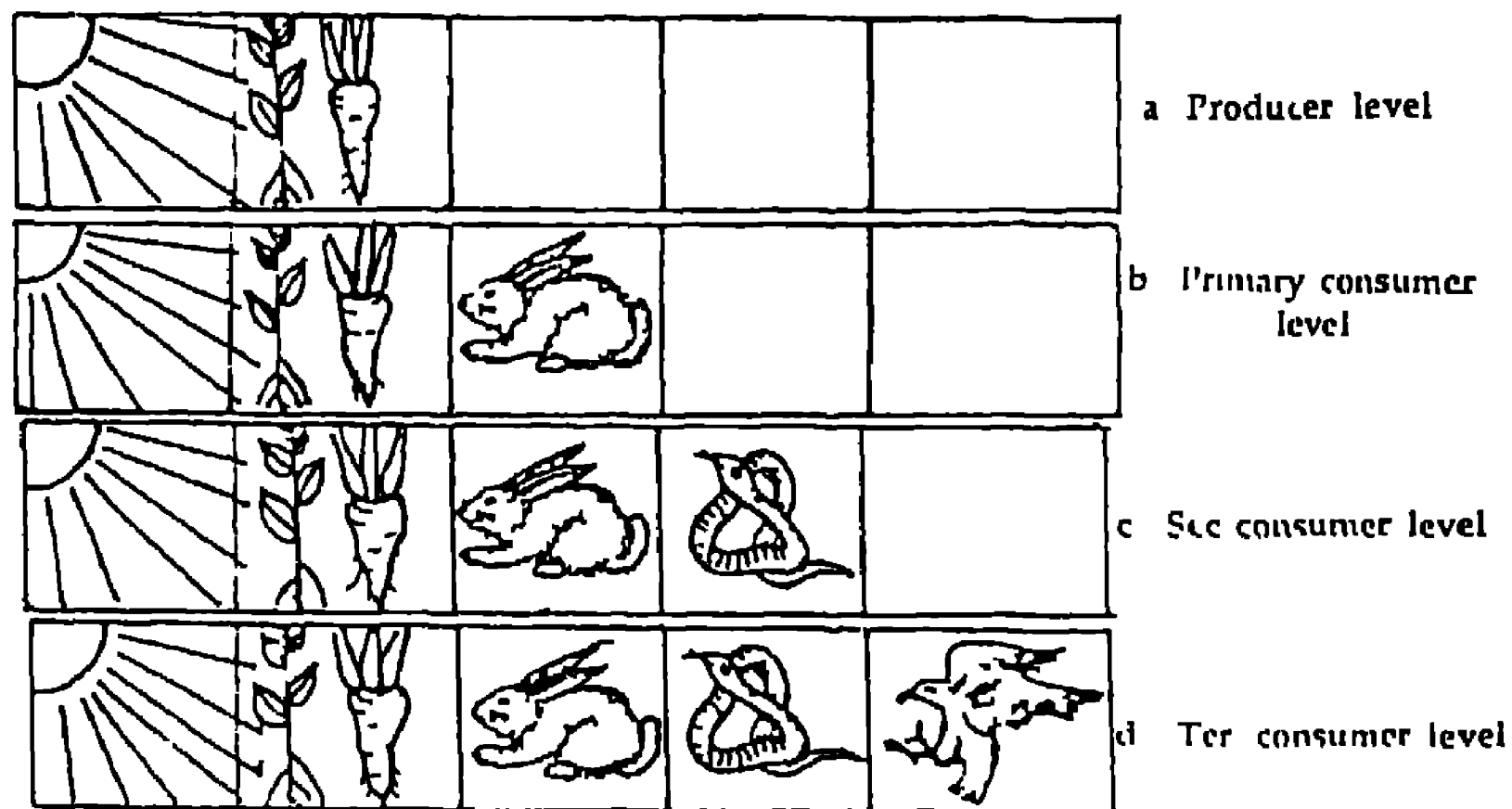


Fig. 4.6: Progression of the Biotic Components of Ecosystem

B. Consumers

Organisms which can't prepare food materials and depend on other organisms directly or indirectly are called consumers. Consumers digest the complex food materials of the producers and rearrange them into new materials according to their requirement.

1. Macro Consumers

These are animals that eat different kinds of food materials. These are also called phagotrophs. Macroconsumers are of three types namely,

- a Primary consumers
 - b Secondary consumers and
 - c Tertiary consumers
- a. Primary consumers

Primary consumers depend on the producers (plants) directly for their food materials. Hence they are called

herbivores They occupy the second position in the food chain Herbivores are the principal source of food for secondary and tertiary consumers So herbivores are also called secondary producers or non-autotrophic producers

Eg Goat, sheep, cattle, horse, snails, rat, rabbit, etc

b. Secondary consumers

Secondary consumers satisfy their hunger by consuming either producers or herbivores or both They occupy the third position in the food chain. Because of their wide range of food source, these are also called omnivores Secondary consumers are also called small carnivores

Eg Foul, frog, cat, dog, some fishes, snakes, etc

c. Tertiary consumers

These are top order carnivores or predators They depend on primary and secondary consumers for their food. No other organism depends on the tertiary consumer for its food These predators occupy the terminal position in the food chain.

Eg Lion, tiger, vulture, hawk, etc

2. Decomposers

These are also called microconsumers or saprotrophs or osmotrophs or transformers

Eg Saprophytic bacteria and Fungi.

The complex organic substance (proteins, carbohydrates and lipids) present in the dead bodies of plants and animals are broken down (decomposed) into simpler inorganic materials by these decomposers. Hence these are also called

disposers or scavengers. As a result the materials locked up in the living organisms are released into the environment. Thus the decomposers play an important role in the recycling of materials in the ecosystem. Some of these simpler materials are absorbed by the decomposers for their own use.

Trophic Level

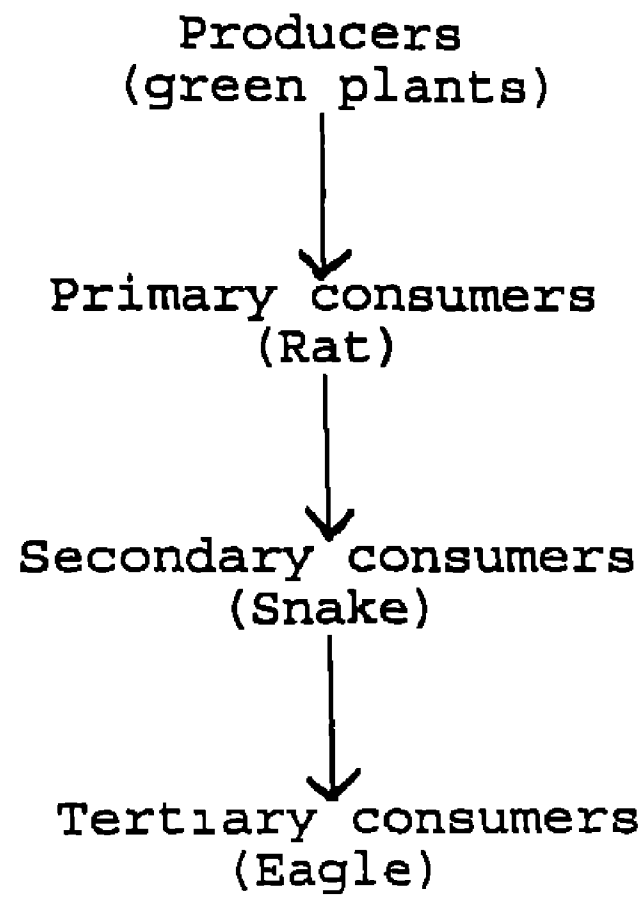
There are different food levels in every ecosystem. Each food level is called a trophic level. An ecosystem, thus, consists of four trophic levels. Food energy is always transferred from one trophic level to another in an ecosystem along a food chain. Producers form the first or basic trophic level.

There is wastage of energy as well as material when food passes from one trophic level to another.

Food Chain

In any ecosystem, producers and different types of consumers are arranged in a linear manner with respect to their food relations. Energy-rich food passes from producers to primary consumers, secondary consumers and finally to tertiary consumers in a stepwise manner. This transfer of food energy from producers through a series of organisms with repeated eating and being eaten is known as food chain.

It may be represented as follows



There are two major types of food chains namely,

- 1 Grazing food chain
- 2 Detritus food chain

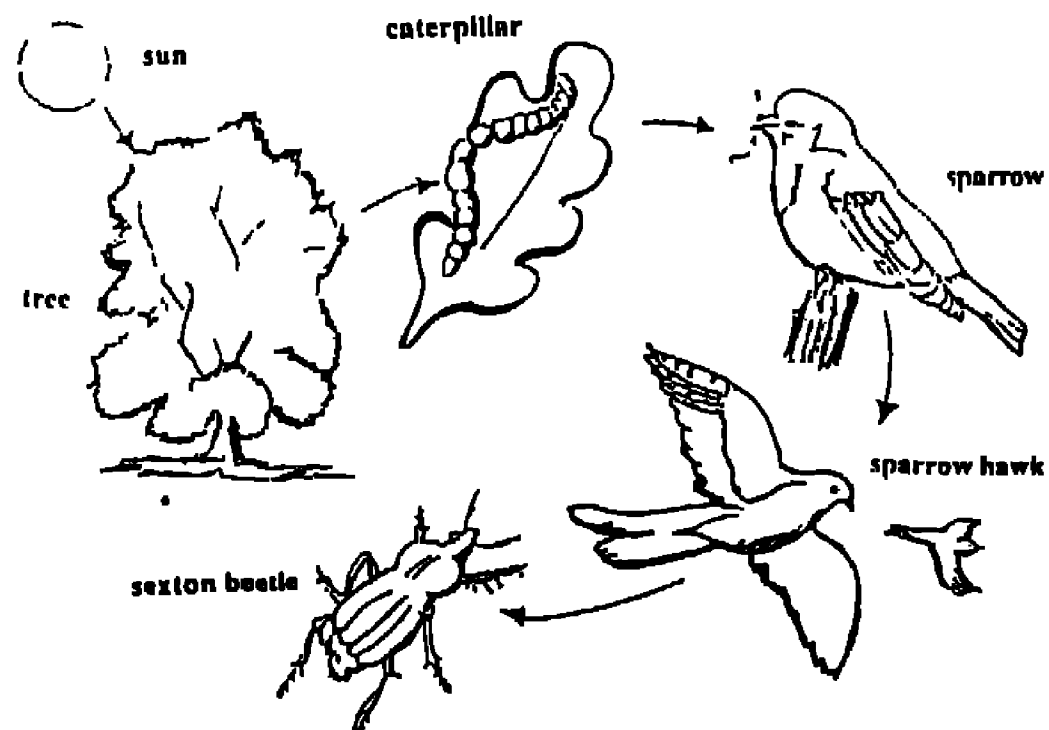


Fig. 4.7: Food Chain

Food Web

An ecosystem consists of producers, and different kinds of consumers. The food habits of all the consumers are not the same. Due to these varied food habits a number of food chains will be operating at the same time in the same ecosystem. These food chains are interlinked with each other at one or more points. This interlocking pattern of a number of food chains forms a web-like arrangement, known as food web. Food web maintains the stability of the ecosystem.

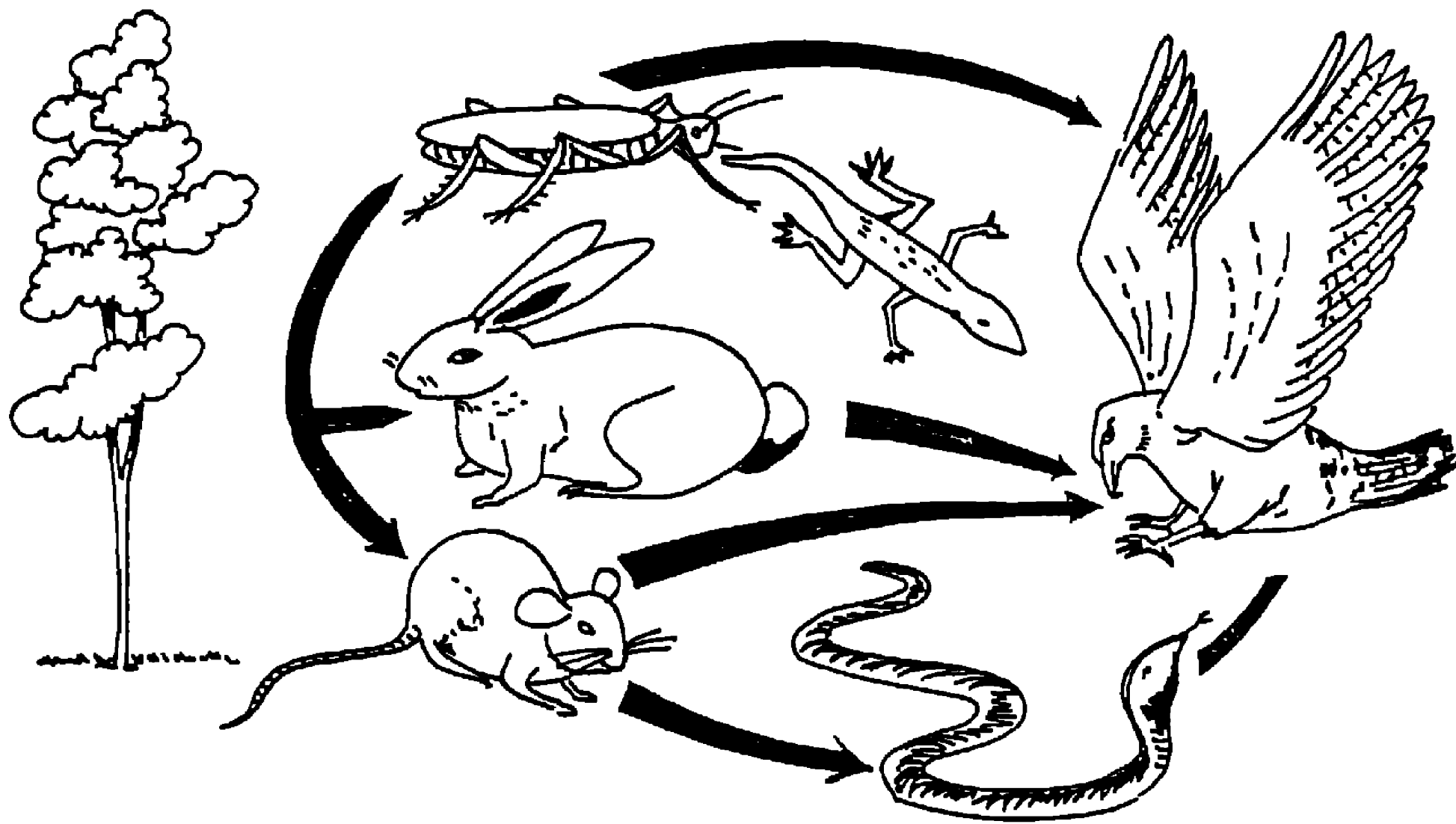


Fig. 4.8: Food Web

Ecological Pyramids

The concept of ecological pyramids was introduced by Charles Elton. The graphic representation of the trophic structure of an ecosystem in the form of a pyramid is called ecological pyramid. Usually producers (first trophic level) are represented at the base of the pyramid.

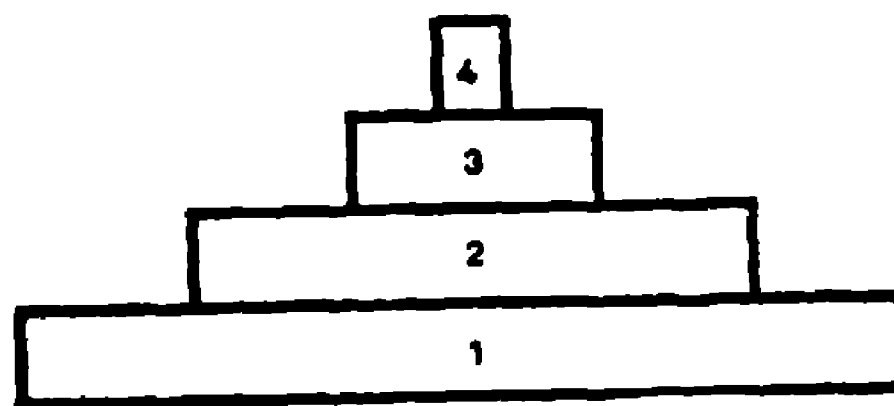
The other successive trophic levels (primary, secondary and tertiary consumers) are represented one above the other leading to the tip of the pyramid.

There are three types of ecological pyramids namely,

1. Pyramid of numbers
2. Pyramid of biomass and
3. Pyramid of energy

1. Pyramid of numbers

Here, different trophic levels of the ecosystem are arranged according to the number or abundance of organisms. This pyramid shows the number of individual organisms at each level. Pyramid of numbers is usually upright. But in tree ecosystem, it is inverted.



1. Primary producers
2. Primary consumers
3. Secondary consumers
4. Tertiary consumers

Fig. 4.9: Pyramid of Numbers

2. Pyramid of biomass

Here, different trophic levels of the ecosystem are arranged according to the biomass of the organisms. This pyramid shows the total amount of living matter (fresh weight or dry weight) present in each level. Pyramid of biomass is usually upright. But in pond ecosystem, it is inverted because the biomass gradually increases from the producers to carnivores.

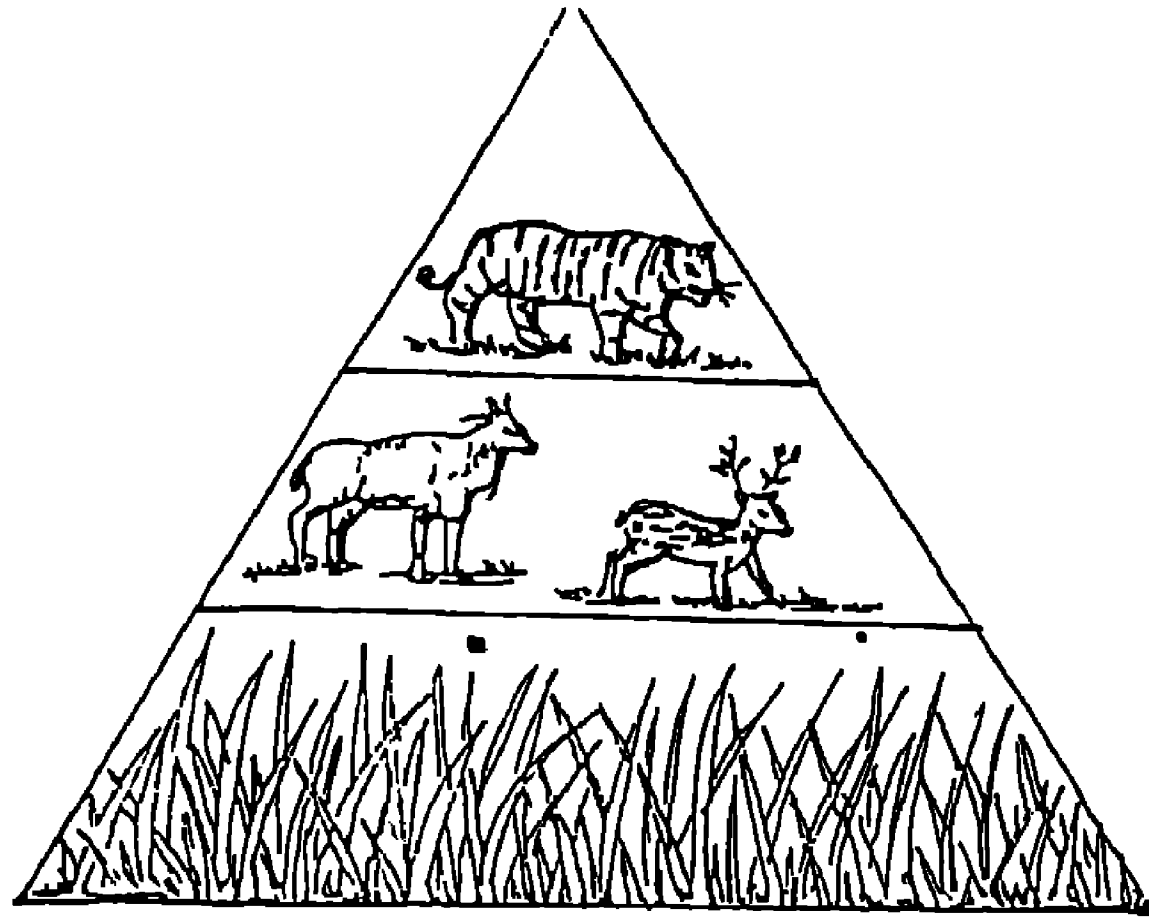


Fig. 4.10: Pyramid of Biomass

3. Pyramid of energy

Here, different trophic levels of the ecosystem are arranged according to the rate of energy flow. This pyramid shows the rate of flow of energy or passage of food mass through the food chain. Pyramid of energy is always upright because of the gradual decrease in the energy content at successive trophic levels from the producers to consumers.

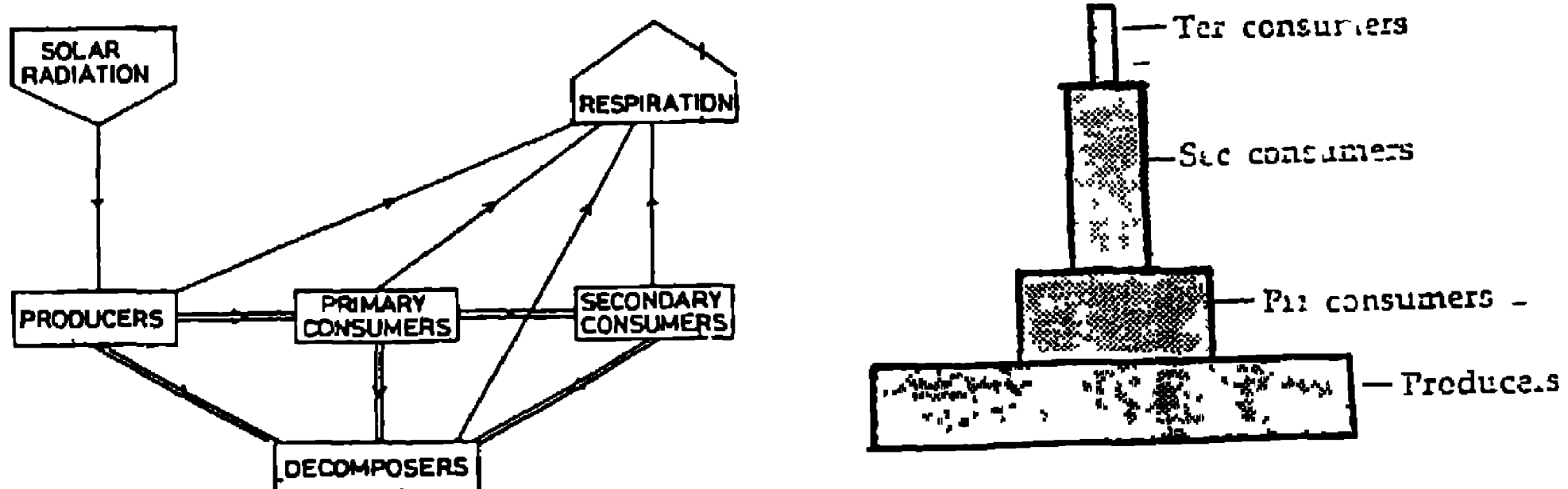
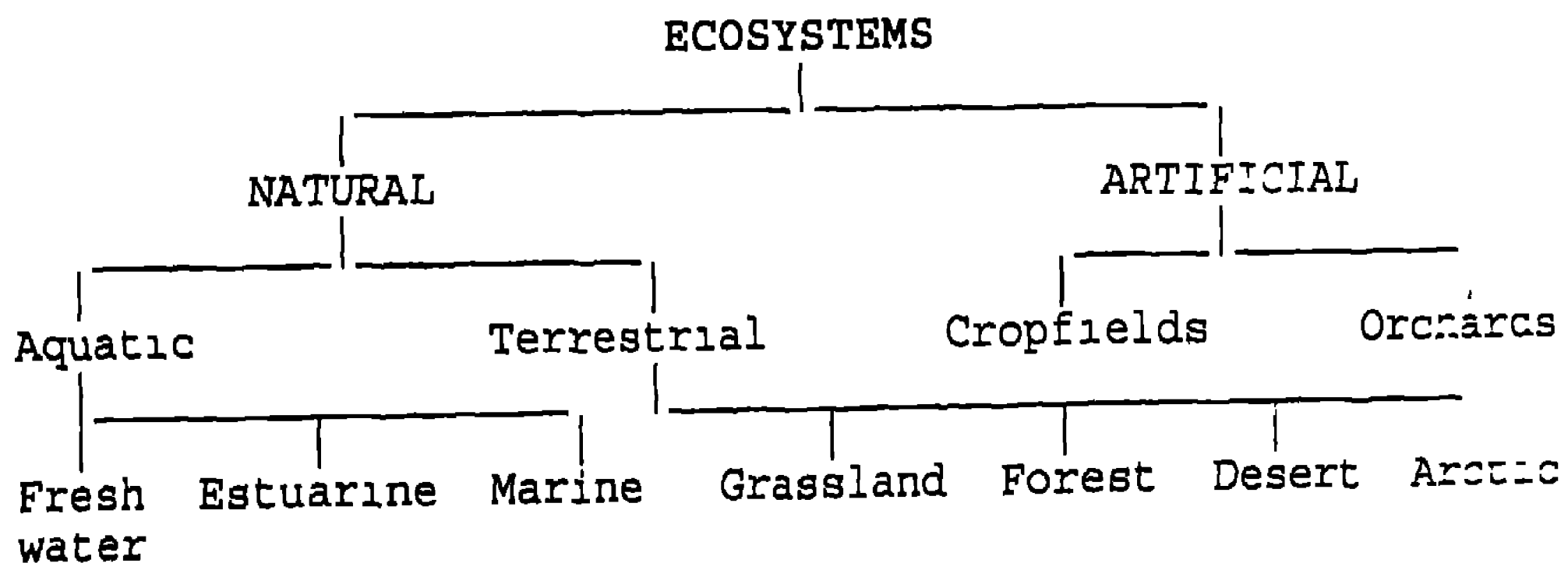


Fig. 4.11: Pyramid of Energy

Kinds of Ecosystems

There are different kinds of climatic conditions on the earth. Similarly the flora and fauna also show great variations in different regions of the earth's surface. In other words, the composition of nature is not the same all over the earth. The planet earth with its diverse forms of life and climate constitutes the biggest or giant ecosystem - the ecosphere or biosphere. Earth is a complex mixture of many ecosystems. Different ecosystems of the earth may be classified as follows:



POND ECOSYSTEM

Pond or lake is an ideal example of fresh water lentic ecosystem. A pond exhibits a self-sufficient and self-regulating system. It contains all the components of an ecosystem. The different components of pond ecosystem are:

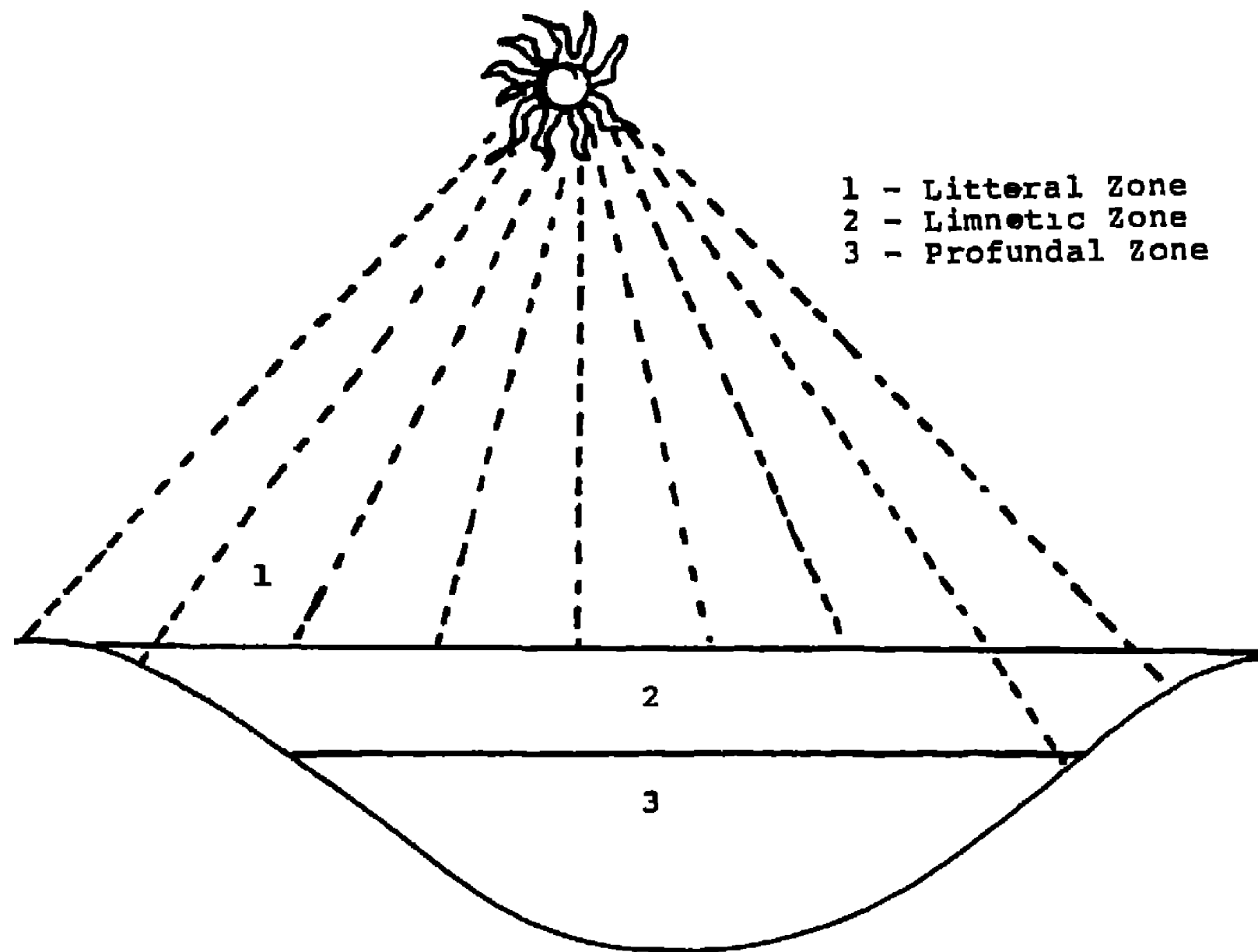


Fig. 4.12: Zonation of a Pond

1. Abiotic Components

The non-living component consists of the following materials

A. Inorganic Materials

Different types of inorganic substances like the salts of calcium, magnesium, nitrogen, phosphorous, potassium, etc are found in a dissolved state in water. Thus the pond water itself acts as a weak nutrient mineral solution.

B. Organic Materials

Many organic compounds like aminoacids, organic acids, humic acid, carbohydrates are found in the mud as well as in water. These are formed from the plant and animal debris.

C. Gases

Important gases like O_2 and CO_2 are found in a dissolved state in water.

Besides the above materials other abiotic components of pond ecosystem are light, temperature, pH of water

2. Biotic Components

Biotic component of a pond ecosystem consists of

- A Producers
- B Consumers
- C Decomposers

A. Producers

All autotrophic organisms which serve as a source of food for consumers are called producers. Photosynthetic higher plants, algae, photosynthetic and chemosynthetic bacteria come under this category. Photosynthetic plants produce energy rich carbohydrates by utilising CO₂, H₂O with the help of solar energy.

Producers are of two types, viz.

- a Macrophytes and
- b Microphytes or phytoplankton

a. Macrophytes

These are higher plants which are usually big. Different types of macrophytes are

- 1 Free floating plants: Pistia, Eichhornia, Wolffia, Lemna, Azolla, Salvinia, Spirodella, etc
- 2 Submerged plants Utricularia, Hydrilla, Vallisneria, Ceratophyllum, Chara and Nitella (algae), Ottelia, etc
- 3 Emergent plants: These are usually rooted along the margins of the pond (marginal plants). Typha, Sagittaria, Ranunculus, Eleocharis, Potamogeton, Marsilea, Trapa, Aponogeton, Nymphaea.

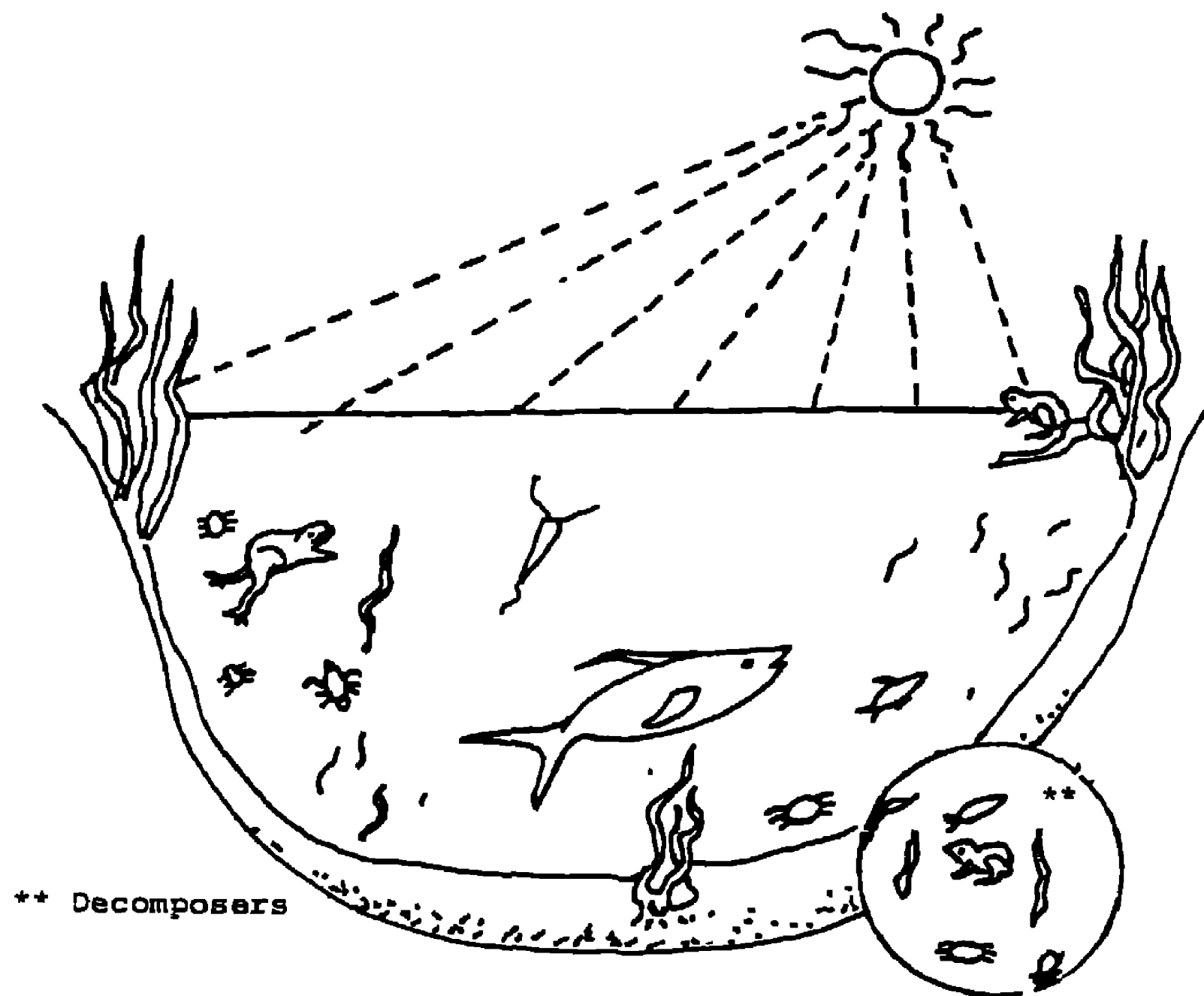


Fig. 4.13: Pond Ecosystem Structure

b. Microphytes or Phytoplankton

These are usually microscopic lower life forms. They become conspicuous and dominant when conditions are favourable. Green colour of pond water is due to phytoplankton. Phytoplanktonic forms may be floating or suspended in water.

Eg. Filamentous green algae Spirogyra, Zygnema, Ulothrix, Oedogonium, Cladophora, etc.

Filamentous blue-green algae

Nostoc, Oscillatoria, Anabaena, Gloeotrichia, Lyngbya

Some of these blue-greens form water blooms.

Unicellular forms

Desmids like, Closterium, Cosmarium; Diatoms like, Pinnularia, motile unicellular forms like Chlamydomonas, non-motile unicellular forms like, Chlorella, etc.

Colonial forms

Pandorina, Eudorina, Volvox, Pediastrum, etc

Generally the biomass of producers is more towards the margins of the pond and gradually decreased towards the centre. Similarly, the energy content of the marginal plants is more than those present in the centre (phytoplankton). Energy content of the macrophytes is measured with oxygen bomb calorimeter. Energy content is expressed as cal/gm dry weight. Biomass of phytoplankton is obtained after centrifugation and expressed as number per unit area-average biomass/cubic meter water.

B. Consumers

These are heterotrophic higher organisms which depend directly or indirectly on producers. Consumers of a pond may be classified as follows:

- 1 Primary consumers
 - 2 Secondary consumers
 - 3 Tertiary consumers
1. Primary consumers

These are herbivorous animals that feed on producers directly. Herbivorous consumers may be larger or microscopic. Depending on their position in the pond, the primary consumers are further divided into:

a. Neuston

These are unattached organisms that live at the air-water interface. They may be floating (epineuston). Eg. Water striders or suspended just below the water surface (hyponeuston). Eg. diving beetles, insect larvae, etc.

b. Zooplankton

These animals occupy the same place as phytoplankton. They feed (graze) on phytoplankton. They include minute animals like Euglena, Coleps, Dileptus (protozoans), Cyclops, Daphnia, Stenocypris (crustaceans); Brachionus, Asplanchna, Lecane (rotifers), etc

c. Periphyton

These are herbivores which are attached to the macrophytes. Eg water mites, leeches, snails, Vorticella, Hydra

d. Nekton

Nektonic animals are swimmers which are relatively bigger in size.

Eg. fishes, swimming insects, etc.

e. Benthos

These are primary consumers which live at the bottom of the pond. These are also called detritivores

Eg: molluscs, insect larvae, beetles, tube worms, etc.

Biomass of benthic fauna is expressed as g/m^2

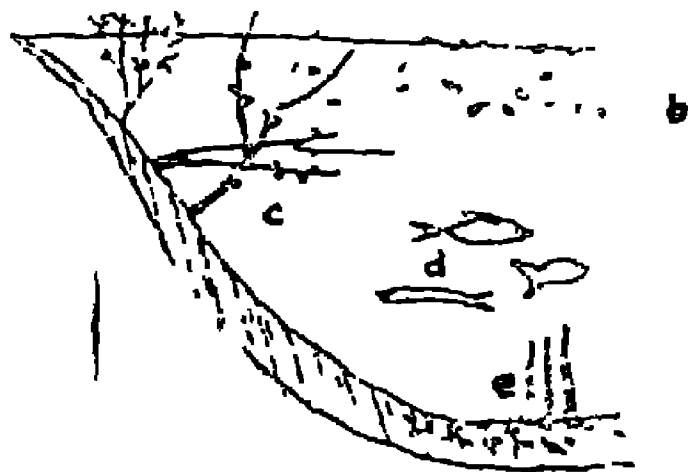


Fig. 4.14: Primary Consumers

2. Secondary consumers

These animals feed primarily on herbivores

Eg. water insects, water birds, some fish, frogs, etc

3. Tertiary consumers

These high ranking consumers feed on secondary consumers Eg Some birds, large fish, snakes, etc

4. Decomposers

These are saprophytic heterotrophs seen mostly in the mud at the bottom of ponds. These organisms decompose the dead bodies of plants and animals, degrade the complex materials into simpler substances and add them to the ecosystem. Thus the decomposers help the recycling of materials in the pond ecosystem. Eg saprophytic bacteria, actinomycetes, fungal species like Aspergillus, Saprolegnia, Allomyces, Chytrids, Fusarium, Penicillium, etc

Some of the polluted Indian rivers

River	Polluting industry (ies)
Bhadra (Karnataka)	Paper and steel industries
Cauvery (Tamil Nadu)	Tanneries, distilleries, paper and rayon mills
Chambal (M.P)	Rayon mills, caustic soda mills
Cooum (Tamil Nadu)	Automobile workshops
Damodar (between Bokaro and Panchet)	Fertilisers, steel mills, coal washeries and power stations
Ganga (at Kanpur, UP)	Chemical, metal and surgical instrument industries, tanneries, textile mills
Godavari (A.P)	Paper mills

River	Polluting industry (ies)
Gomti (near Lucknow, UP)	Paper and pulp mills
Hooghly (near Calcutta, WB)	Power stations, paper, pulp, jute, textile and chemical mills; paint, varnishes, metal, steel, vegetable oils, rayon, soap, match, shellac and polythene industries

Wild Life Conservation

The wild life refers to all the living organisms in their natural habitat other than the cultivated plants and domestic animals



Fig. 4.15: White Tiger

Our country is endowed with a rich biological heritage, and our scriptures and epics are full of vivid and beautiful

accounts of wild life. India has a great natural resource comprising of 75,000 species of animals (800 species of mammals, 2000 of birds, 420 of reptiles, 2000 of fish, 50,000 insects, 4000 of molluscs) and 45,000 plant species of which 7,000 are endemic to India

According to IUCN (International Union for Conservation of Nature and Natural Resources, World Conservation Union) 25,000 plant species are threatened with extinction. In India, nearly 132 plant species, 71 species of mammals, 47 species of birds, 15 species of reptiles have been declared threatened. These are listed in the "Red Data Book"

IUCN classified the plants and animals into four groups

(i) **Endangered species (E)** These are represented by few individuals because of unfavourable environmental or human factors. These species would become extinct soon, if the same factors continue to exist

eg. Rhinoceros, Asiatic Lion and Great Indian Bustard

(ii) **Vulnerable species (V)**: These are the species having sufficient number of individuals in their habitats. However in the near future, they may represent the category of endangered species, if unfavourable conditions continue to operate.

(iii) **Rare species (R)**: The species with small world population that are not vulnerable or endangered, but are at risk. These are thinly scattered over a more extensive range

(iv) **Threatened species (T):** These are species which fall in one of the three categories viz E or V or R

Reasons for extinction of wild life

1. Destruction of habitats

(a) **Absence of cover or shelter.** Shelter is very important for wild life provided by forest vegetation, margins of river and uneven grounds. If shelter is removed animals will not survive.

(b) **Reduction in the area of movement.** The reduction of free area for movement reduces the reproductive capacity of some wild animals like rhino, tiger, bison, etc.

(c) **Destruction of wild plants.** It deprives the wild animals, their food and affects their survival.

(d) **Building roads and railways.** These roads and railways across the forests reduce the area of free movement for the wild animals.

(e) **Pollution.** Pollution in the forest also adversely affects wild animals.

(f) **Destruction of habitat of scavengers.** The destruction of habitats of scavengers like vultures, kites also affect wild animals.

2. Hunting

Excessive hunting of animals has caused destruction of wild life. The disappearance of Dodo bird from Mauritius and Cheetah from India is mainly due to over hunting.

3. Introduction of exotic species

Introduction of exotic species affects native species. Exotic species increase competition for food, space, destroy

the habitats and introduce diseases. Goats and rabbits introduced in islands of Pacific Ocean and Indian Ocean destroyed the habitats of plants, birds and reptiles

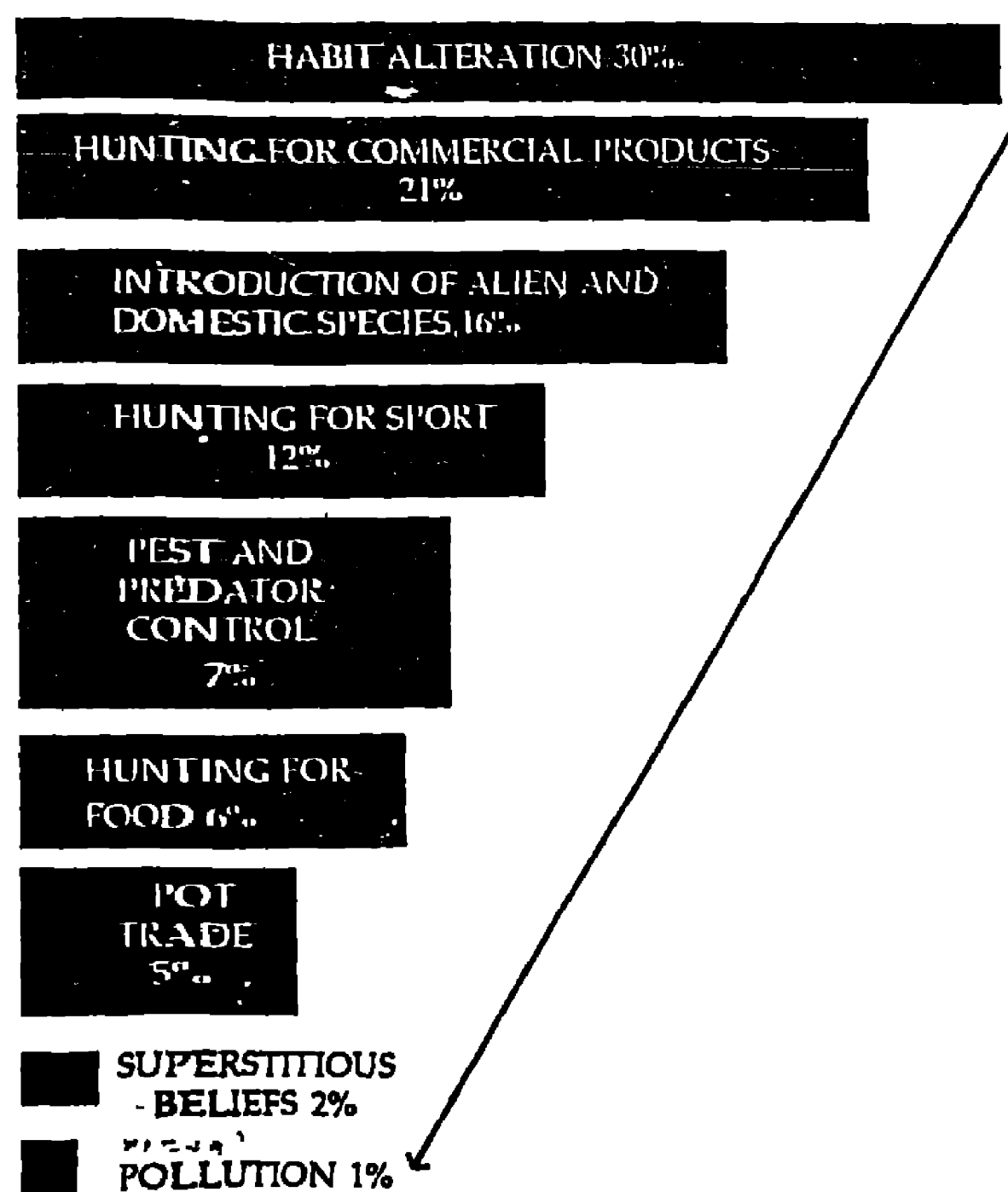


Fig. 4.16: A Break up of Human Activities that Cause Extinction of Wildlife

4. Disturbance in migratory routes: Disturbances in migratory routes severely affect the populations

5. Legal lapse: The existing laws are not adequate to protect our wild life

6. Human ignorance: It is the primary factor responsible for the depletion of wild life.

Conservation of wild life

(a) Need for conservation of wild life

- (i) Wild life should be conserved to maintain the stability of ecosystem.
- (ii) To preserve natural genetic stock.
- (iii) For economic benefits
- (iv) For game value
- (v) For scientific value.
- (vi) For aesthetic value.

(b) Conservation of energy

For conservation of wild life the following should be considered

- (i) Maintenance of the ecological equilibrium between biotic and abiotic components of the ecosystem
- (ii) Preservation of the total gene pools of the different species at the global level
- (iii) Ensuring the optimum utilisation of the present animal and plant species

Any conservation strategy should include the following management measures

- (i) Protecting the natural habitats through controlled exploitation of species
- (ii) Maintaining their viable number in national parks, sanctuaries, game reserve, botanical gardens, arboreta, etc
- (iii) Survival of the most endangered species through maintenance of breed stock in zoological parks

(iv) Establishment of flora reserve and ecosystem reserves in the country

(v) Protection through coordinated legislative measures

Several developmental schemes can also adopted simultaneously for the protection of wild life

(i) The betterment of existing sanctuaries.

(ii) To create the buffer belts around the sanctuaries

(iii) Imposition of restriction on export of rare animals and plants

(iv) Use of scientific methods of rearing for the enhancement of population

(v) Wild life conservation and its benefits to society to be introduced in school and college study

Wild life Protection in India

India had the physical conditions ranging from cold deserts of Ladakh and Spiti to the hot desert of the Thar, temperate forest in Himalayas to the tropical low land forests and also the lakes like Wular and Manashal in Kashmir, Kolleru in Andhra Pradesh, (fresh water lakes) back water lakes like Chilka in Orissa and Pulikat in A P and Tamil Nadu, rich ocean sources of South.

Government of India constituted Central Board for Wild Life in 1952 as an advisory body. It is renamed as Indian Board for Wild Life (IBWL). States in India also formed their own Wildlife Advisory Boards (WAB). Government of India enacted Wildlife Protection Act 1972 to protect the wild life. Biosphere reserves are created from 1986 for the

preservation of wild life ZSI (Zoological Survey of India at Calcutta) and BSI (Botanical Survey of India at Lucknow) have also engaged wild life protection programmes The Bombay Natural History Society (BNHS) and Wildlife Preservation Society of India (WPSI) are also concerned about the wildlife preservation

Names and Location of Biosphere Reserves of India

Biosphere Reserves	States/Union Territory
1. Nilgiri (First Biosphere reserve established in 1986)	Kerala, Karnataka and Tamil Nadu
2. Namdapha	Arunachal Pradesh
3 Nanda Devi	Uttar Pradesh
4 Uttarakhand (Valley of Flowers)	Uttar Pradesh
5 North Islands of Andamans	Andaman and Nicobar Islands
6 Great Nicobar	Andaman and Nicobar
7. Gulf of Mannar	Tamil Nadu
8. Kaziranga	Assam
9. Manas	Assam
10 Sunderbans	West Bengal
11 Thar Desert	Rajasthan
12 Kanha	Madhya Pradesh
13. Nokrek	Meghalaya
14 Little Rann of Kutch	Gujrat

Some Protected Indian Wild Animals

Mammals

- 1 Black buck (Antelope cervicapra)
- 2 Capped langur (Presbytis pileatus)
- 3 Chital (Axis axis)
- 4 Clouded leopard (Neofelis nebulosa)
5. Crab-eating macaque (Macaca irus umorosa)
- 6 Fishing cat (Felis viverrina)
7. Flying squirrels (Petaurista, Eupetaurus, Belomys,
Hylopetes, All species)
8. Four-horned antelope (Tetracerus quadricornis)
9. Gangetic dolphin (Platanista gangetica)
- 10 Giant squirrels (Ratufa macroura, R indica, R biocolor)
11. Golden cat (Felis temminckii)
12. Golden langur (Presbytis geei)
- 13 Himalayan black bear (Selenarctos tibetanus)
- 14 Himalayan brown bear (Ursus arctos)
15. Himalayan crestless porcupine (Hystrix hodgsoni)
- 16 Hispid hare (Caprolagus hispidus)
- 17 Hoolock or gibbon (Hylobates hoolock)
- 18 Hyaena (Hyaena hyaena)
- 19 Indian elephant (Elephas maximus)
- 20 Indian lion (Panthera leo persica)
- 21 Indian pangolin (Manis crassicaudata)
- 22 Indian wild ass (Equus hemionus khur)
- 23 Indian wolf (Canis lupus)
- 24 Kashmir stag or hangul (Cervus elephus hanglu)

- 25 Leopard or panther (Panthera pardus)
26. Leopard cat (Felis bengalensis)
- 27 Lesser or red panda (Ailurus fulgens)
- 28 Lion-tailed macaque (Macaca silenus)
- 29 Loris (Loris tardigradus)
- 30 Musk deer (Moschus moschiferus)
- 31 Nilgai (Boselaphus tragocamelus)
- 32 Nilgiri langur (Presbytis johni)
- 33 Otters (Lutra lutra, L. perspicillata, Aonyx cinerea)
- 34 Pig-tailed macaque (Macaca nemestrina)
35. Pigmy hob (Sus sylvanus)
- 36 Red fox (Vulpes vulpes)
- 37 Rhinoceros (Rhinoceros unicornis)
- 38 Sambhar (Cervus unicolor)
- 39 Sloth bear (Melursus ursinus)
- 40 Slow loris (Nycticebus coucang)
- 41 Snow leopard (Panthera uncia)
- 42 Swamp deer or gond (Cervus duvauceli, all species)
- 43 Tibetan antelope or chiru (Pantheloope hogsoni)
- 44 Tibetan fox (Vulpes ferrilatus)
- 45 Tibetan wild ass (Equus hemionus kiang)
- 46 Tiger (Panthera tigris)
- 47 Wild buffalo (Bubalus bubalis)
- 48 Wild dog or dhole (Cuon alpinus)
- 49 Wild pig (Sus scrofa)
- 50 Wild yak (Bos grunniens)

Reptiles

- 51 Estuarine crocodile (Crocodilus porosus)
- 52. Gharial (Gavialis gangeticus)
- 53. Leathery turtle (Dermochelys coriacea)
- 54 March crocodile (Crocodilus palustris)
- 55 Monitor lizards (Varanus griseus, V. bengalensis,
V flavescens, V salvator, V nebulosus)
- 56 Pythons (Python molurus, P reticulatus)

Birds

- 57 Cheer peasant (Catreus wallichii)
- 58 Great Indian bustard (Choriotis nigriceps) .
- 59 Great Indian hornbill (Buceros bicornis)
- 60 Large falcons (Falco peregrinus, F biarmicus,
F chicquera)
- 61 Mountain Quail (Oppassia superciliosa)
- 62 Peafowl (Pavo cristatus) .
- 63 Pink headed duck (Rhodonessa caryophyllacea)
- 64 Siberian white crane (Grus leucogeranus)

Amphibians

- 1 Himalayan newt (Tylototriton verrucosus)
- 2. Viviparous toad (Nectophryne tuberculosa)

Some National Parks and Wildlife Sanctuaries of India

Name and Location	Area sqkm	Important Animals found
1. Kaziranga National Park, District Sivasagar, Assam	430	Rhinoceros, elephant, wild buffalo, bison, tiger, leopard, sloth bear, samohar, swan, deer, barking deer, wild boar, gibbon, python, and birds like pelican, stork and ring-tailed fishing eagles. This is a famous National Park for famous one-horned rhinoceros of India
2. Sunderbans (Tiger Reserve) 24-Paraganas, West Bengal	2582	Tiger, wild boar, deer, gangetic dolphin, estuarine crocodile
3. Jaldapara Sanctuary Madarihat, West Bengal	1155	Rhino elephant, tiger, leopard, gaur, deer, sambhar, different kinds of birds
4. Hazaribagh National Park, Hazaribagh, Bihar	186	Tiger, leopard, hyaena, wild boar, gaur, sambhar, nilgai, chital, sloth bear, peafowl
5. Corbett National Park, District National, Uttar Pradesh	525	Tiger, elephant, panther, sloth bear, wild boar, nilgai, sambhar, chital, crocodile, python, king cobra, peafowl, partridge This is the first National Park of India which is famous for tigers
6. Gir National Park, District Junagarh, Gujrat	1412	Asiatic lion, panther, striped hyaena, samohar, nilgai, chital 4-horned antelope, chinkara, wildboar, langur, python, crocodile, green pigeon, partridge This national park is famous for the Asiatic lions

Name and Location	Area sqkm	Important Animals found
7 Keoladeo Ghana National Park, Bharatpur, Rajasthan	29	Siberian crane, stroks egrets, herons, spoon bill, etc Drier parts of this marshy sanctuary have spotted deer, black buck, sambhar, wild board, blue bull, python This sanctuary is famous for birds
8 Desert National Park, Jaiselmer, Rajasthan	3000	Great Indian bustard, black buck, chinkara
9. Sultanpur Lake Bird Sanctuary, District Gurgaon, Haryana	12	Crane, sarus, spot bill, duck, drake, green pigeon, wild boar, crocodile, python
10 Bir Moti Bagh Wild Life Sanctuary, District Patiala, Punjab	83	Nilgai, wild boar, hog deer, black buck, blue bull, jackal, peafowl, partridge, sparrow, myna, pigeon, dove.
11 Shikari Devi Sanctuary, Mandi, Himachal Pradesh	213	Black bear, snow leopard, flying fox, barking deer, musk deer, chakor, partridge
12 Dachigam Sanctuary, Srinagar, Jammu & Kashmir	89	Hangul or Kashmir stag, musk deer, snow leopard, black bear, brown bear
13 Kanha National Park, Mandla and Balaghat, Madhya Pradesh	940	Tiger, panther, chital, chinkara, barking deer, blue bull, four horned deer, langur, wild boar, black buck, nilgai, wild dog, sloth bear, sambhar, crocodile, grey horn bill, egret, peafowl
14 Tandoba National Park, Chandrapur, Maharashtra	116	Tiger, sambhar, sloth bear, bison, chital, chinkara, barking deer, blue bull, four horned deer, langur, peafowl, crocodile

Name and Location	Area sqkm	Important Animals found
15 Bandipur National Park, District Mysore, Karnataka	874	Elephant, tiger, leopard, sloth bear, wild dog, chital, panther, barking deer, langur, porcupine, gaur, sambhar, malabar squirrel, green pigeon
16 Annamalai Sanctuary, District Coimbatore, Tamil Nadu	958	Elephant, tiger, panther, gaur, sambhar, spotted deer, sloth bear, wild dog, barking deer, langur, porcupine
17 Mudumalai Wildlife Sanctuary, District Nilgiri, Tamil Nadu	321	Elephant, gaur, sambhar, chital, barking deer, mouse deer, four horned antelope, langur, giant squirrel, flying squirrel, wild dog, jackal, wild cat, civet, sloth bear, porcupine, python, rat, snake, monitor lizard, flying lizard
18 Mundanthurai Sanctuary, Dist Thirunelveli, TN	520	Panther, tiger, sambhar, chital
19 Nagarjuna Sagar (Ikshawaka Sanctuary) Guntur, Prakashan, Kamool, Mahbubnagar and Nalgonda, Andhra Pradesh	3568	Tiger, panther, wild bear, chital, nilgai, sambhar, black buck, fox, jackal, wolf, crocodile.
20 Periyar Sanctuary, District Idukki, Kerala	777	Elephant, tiger, panther, gaur, leopard, sloth bear, sambhar, barking deer, wild dog, wild boar, black Nilgiri, langur, hornbill, egret
21 Chilka Lake Bird Sanctuary, Balagaon, Orissa	900	Water fowls, ducks, cranes, ospreys, golden plovers, sandpipers, stone curlews, flamingoes.

Activity 1

Place the following words in the table given below

(i) Moss, (ii) Short grasses, (iii) Teak, (iv) Minder, (v) ...

(v) Lichen, (vi) Antelope, (vii) Sal, (viii) Thorny shrub, (ix) Tall green trees, (x) Elephant, (xi) Camel, (xii) Fir, (xiii) Pine, (xiv) Date palm, (xv) Creepers, (xvi) Silver fox, (xvii) Apes, (xviii) Tiger.

Vegetational belt	Common vegetation	Animals
Tundras		
Taigs		
Steppe		
Arid deserts		
Equatorial forests		
Tropical forests		
Sub-tropical forests		

Activity 2

Map work

Study the physical and political maps of Asia and world from your Atlas and find out the following

1. Mountains. of India
2. Rivers of India
- 3 Countries. of Asia and Europe
4. Cities . The capital cities of India and Britain

Activity 3

A classroom teacher guided discussion on different plants and animals from Indian forests and about the endangered animal biosphere parks.

Activity 4

Discussion about different crops and minerals found in India and their geographical location in a map.

Activity 5

Represent seasonal winds and rainfall in India in a map.

Activity 6

Discussion on the rainfall distribution and its impact on natural vegetation

Map work

Locate the following on the outline map of India

- (1) A place having the world's highest rainfall
- (11) A region receiving rainfall from the north-east monsoon.
- (111) Direction of winds of the Bay of Bengal (branch of the south-west monsoon)

Activity 7

When rain occur in India during which months, which is the causative factor for the rain during these months ?

- 1 South-west monsoon - period - months direction of rain
- 2 North-east monsoon - period - months direction of rain

Activity 8

Which is the lowest rainfall zones of your state List them from year 1999-2000. See the newspaper for data of rainfall.

Activity 9

Setting up of research programmes: In a dynamic concept like habitat improvement the necessity of constant research in various aspects is of paramount importance

Evaluation/Review Questions

One Mark Questions

1. Define Ecology ?
2. Define a food chain ?
3. What is meant by trophic structure ?
4. Write the food chain in grassland ecosystem ?
5. Name the different types of food chains ?
6. Define a ecological pyramid ?
7. What is a pyramid of energy ?
8. What is pyramid of numbers ?
9. What is pyramid of bio-mass ?
10. Name the two types of bio-geochemical cycles
11. What are sedimentary cycles ? Which is their reservoir ?

Two Marks Questions

1. Discuss about global water cycle ?
2. Write the sequence in which energy flows in an ecosystem ?
3. Distinguish between energy flow and nutrient cycle.
4. Give examples to show how two trophic levels differ ?
5. What is food chain ? Write sequences of organisms in a food chain in a pond ecosystem.
6. Define a food web ?
7. Draw pyramid of numbers ?
8. State the physical causes of soil erosion ?
9. Explain afforestation.
10. What is biosphere reserve ?
11. Name the sanctuaries in Karnataka ?

- 12 Name the legislative measures taken to protect wild life in India ?
13. Give reasons for decline of wild life ?
- 14 Which are four categories of species listed in the red data book ?
- 15 What are the uses of zoo's and botanical garden ?
- 16 Name two Indian animals that became extinct in the recent years.
- 17 What is habitat destruction ?
- 18 Name two main types of conservation methods employed in wild life conservation
- 19 Define conservation.
- 20 What is terracing ?
- 21 What is deforestation ?

Four Marks Questions

- 1 Point out the need for conservation of ecosystems ?
- 2 What are the different layers of the earth's atmosphere discuss ?
- 3 What do you mean by secondary pollutants ?
- 4 What is aerosols ? Explain.
- 5 What is pedology ? Explain.
- 6 What is Nekton, Benthods, Periphyton ? Define them
- 7 What is social forestry ? Write a note on Habitat preservation.
- 8 Organisms do not live in vacuum but in an environment ? Discuss

Five Marks Questions

- 1 Give a brief illustrated account of pond ecosystem ?
- 2 Discuss the role of abiotic components in an ecosystem
- 3 What is an ecosystem ? Classify and write a note on each with special reference to India
- 4 Give reasons for considering the ecosystem as an interaction between the biotic and abiotic components ?
- 5 Explain the different types of aquatic ecosystem in India ?
- 6 Name some of the animals who are been conserved in India
- 7 Name the bioreserves specially meant for some animals' conservation in India
Tiger, Lion, Crocodile, Great Indian Hornbill, Nilgiri
Langur

MAPS/PROJECTIONS

MAPS

Introduction

Maps are one of the important tools in geography. It is a geographer's short hand script which has its own language and the person should be well-versed in it to understand and interpret maps.

In this module an attempt is made to make the teachers understand the following

- meaning of 'map'
- basic components of a map-directions, scale, symbols and colours
- types of maps based on scale-large scale and small scale
- ways of representing relief features on a map and their uses - hachures, hill shading, layer colouring and contours

Instructional Objectives

- 1 To recall the definition of a map
- 2 To identify the components of a map
- 3 To describe each of the components and their uses
- 4 To read the legend in a given map
- 5 To develop the skill of preparing a legend.
- 6 To identify various types of maps and classify them on a given criterion.
- 7 To identify various methods of showing relief features on a map.
- 8 To read the relief features with the help of contour maps

- 9 To draw the relief features of the given contour
- 10 To cite examples for the uses of topographical map.

Concepts

Map It is a proportional representation of the earth or a part of it on a flat surface. Direction, symbols and scale are the components of map. Cardinal and intermediary directions are the two types of directions which are used in maps. A direction indicator is shown in every map to position the map in correct orientation for reading the map.

Scale It is the relation between a given distance on the ground and its corresponding distance on the map.

Symbols These are the indicators of various natural and cultural elements like river, crop, road, temple, etc.

Colours Colours are used in maps to indicate the physical features like mountain and deep water. The shades of the colour signify the height of the land from mean sea level.

Legend The key for the symbols and colours used in a map is given as legend. The details of the symbols are explained against each symbol/colour in the legend.

Relief features They are types of land forms found on the surface of earth like hills, valleys, plains, plateau, etc.

Development

The meaning of a map is elicited from the students by asking a number of sequential questions, after an initial introduction by the teacher.

Activity

Teacher hangs a wall map and asks the students questions like

1. What do you see in the diagram ?
2. Where do you find them in reality ?
- 3 Do you find them in the same size as in the figure ?

Other questions leading to the various aspects of a map can be asked.

Components of a map

Directions

Cardinal and intermediate directions can be identified on any map. Cardinal directions are the basic directions, viz North, South, East and West. Usually these are indicated by a direction indicator drawn on a map.

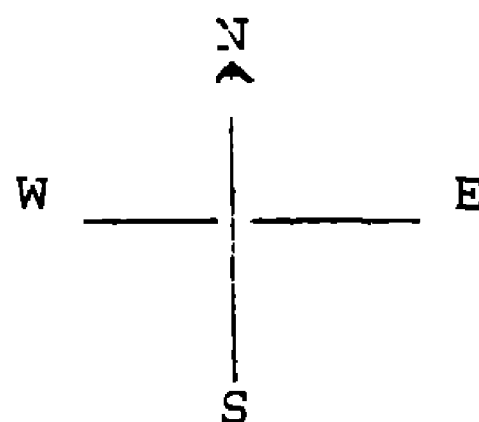


Fig. 5.1: Direction Indicator

With the help of the direction indicator teacher can inform the class of the location of cardinal directions (top of the map stands for north, bottom for south, right hand side of the map uses for east and left hand side for west)

The teacher can ask the students to identify the cardinal directions by locating them in the given figure on the blackboard

The teacher can ask the students to identify some states in relation to directions from political map of India

Identify two states from northern part of India

Name two southern states in the above map

Intermediate directions

These are the directions which are located between two cardinal directions They are

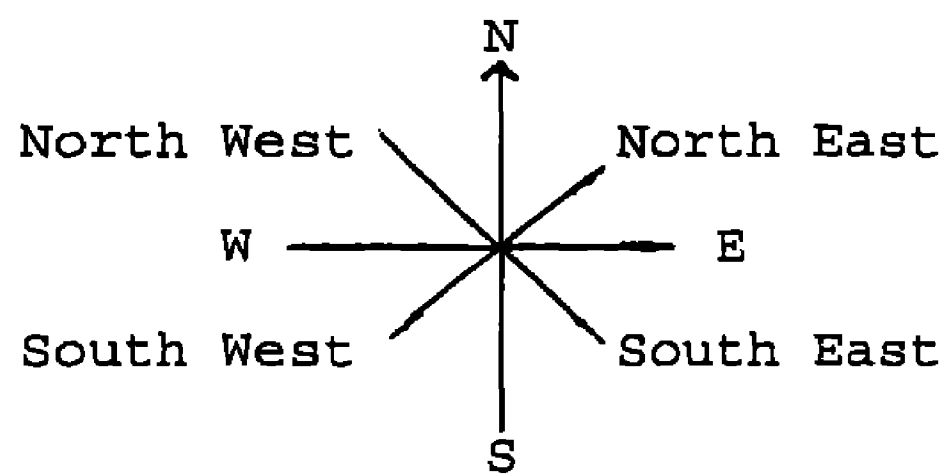


Fig. 5.2: Intermediate Directions

The above diagram can be used by the teacher for the development of the concept of directions as well as for evaluating it

Activity

Taking a map of Asian (political/physical) teacher can ask the children to identify the feature/country with respect to the specified directions

Eg Which country is the south of Japan

Symbols

Conventional symbols are the standard symbols accepted and used internationally

Eg  Town

 Capital town/city

 (Railway) broadgauge

 Road (metallic)

International boundary

Fig. 5.3: Symbols

The teacher can display the chart showing map symbols and their meaning. Students can identify the symbols and read their meaning. Students can be asked to draw these symbols in their note book and write their meaning.

The students can be asked to locate these studied symbols on some of the maps displayed. Non-conventional symbols are those which are drawn by the map maker. These symbols normally resemble the original object in its shape.

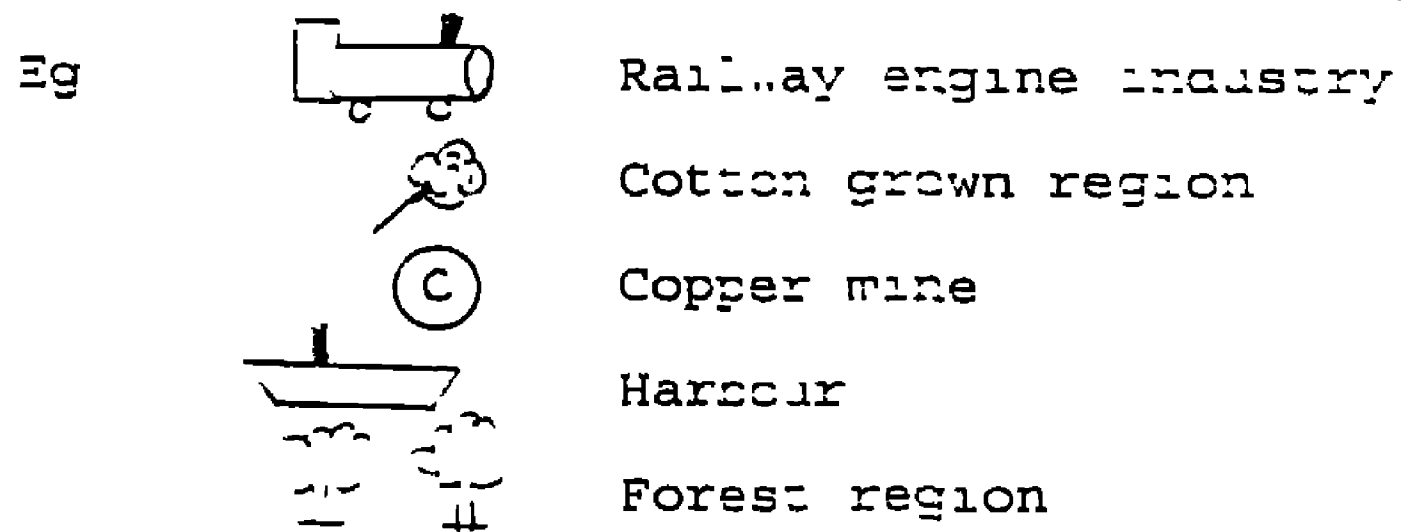


Fig. 5.4: Symbols

The teacher can develop the concept of the conventional symbols in line with the development of concept of conventional symbols using appropriate maps (Fig 5.4).

Colour

Colours are used in maps to indicate the height of the land above the sea level and depth of the water body below the sea level. They are shown through different colours like green, yellow, brown and blue. To show the height or depth, different shades of the above colours (light or dark) are used.

1. Eg. In sea, the various shades of blue indicate various depths of water body - lighter the blue, lesser the depth.
2. Darker the green, lesser the height of the land from the sea level.

3. Darker the brown greater the height from the sea level

Teacher hangs a physical map of India and elicits the students the following

- 1 Highest point - by locating on map
2. Shallow waters - by locating on map
- 3 Deep waters - by locating on map
- 4 River basin - by locating on map

Legend

The teacher explains the feature of a legend used in a map. Students are asked to identify legend on the given map.

The students need the map using the legends.

Teacher can display industries and crops map of India, and ask questions like

- 1 Name the industries found in Arabian coast region
- 2 Name the crops grown in Uttar Pradesh

The teacher can use physical map of India and ask questions

- 3 What is the depth of water near Cape Comorin
- 4 What is the height of land at Calcutta

Scale

There are three types of scales used in a map, viz Statement scale, RF scale and graphical scale.

If the scale is expressed from a statement like

$$1 \text{ cm} = 10 \text{ km}$$

Then it is called a statement scale. This means 1 cm on a map is equal to 10 kms on the ground.

Representative fraction or RF is expression of map scale as a fraction For eg

$$1:1000 \text{ Or } 1/1000$$

$$1 \text{ unit in the map} = 1 \text{ unit on the ground}$$

The statement scale can be converted to RF scale
However care should be taken to have the same units of measurements on both the sides

Statement Scale

Eg $1 \text{ cm} = 10 \text{ km}$
 $1 \text{ cm} = 10 \times 1000 \times 100 \text{ cm}$
 $1 \text{ cm} = 10,00,000 \text{ cm}$

$$\text{Fraction} = 1/10,00,000$$

or

$$\text{Ratio} = 1:10,00,000$$

Activity

- a $1 \text{ cm} = 5 \text{ km}$
- b $10/5000$
- c $1:20,000$
- d $2 \text{ cm} = 15 \text{ km}$

1 Classify the above into statement scale and
R.F scale

2 Convert the given statement scales to RF scales

Geographical Scale (Linear Scale)

The scale represented on a straight line where its length is calculated and divided into primary and secondary divisions according to the requirement is called a graphical or linear scale

Eg Problem Construct a graphical centimetre Scale for

6 kms

Procedure: To calculate the length of the scale

1 cm represents 6 kms

Let the length of the scale be 15 cms. A line 15 cms in length will represent $6 \times 15 = 90$ kms

(No need to convert it into a round number as the above number is already a round number)

Draw a line of 15 cms and divide this line into 15 equal parts, each part represents 6 kms In other words 1 cm on the map represents 6 kms on the ground

Construction

Draw a line AB of 15 cms which is already calculated From A, draw a line AC at an angle of approximately 30° With the help of a divider take convenient length and mark the required number of points to divide the line AC into 15 equal divisions and name them as 1' 2' 3' respectively (Fig. 5.5)

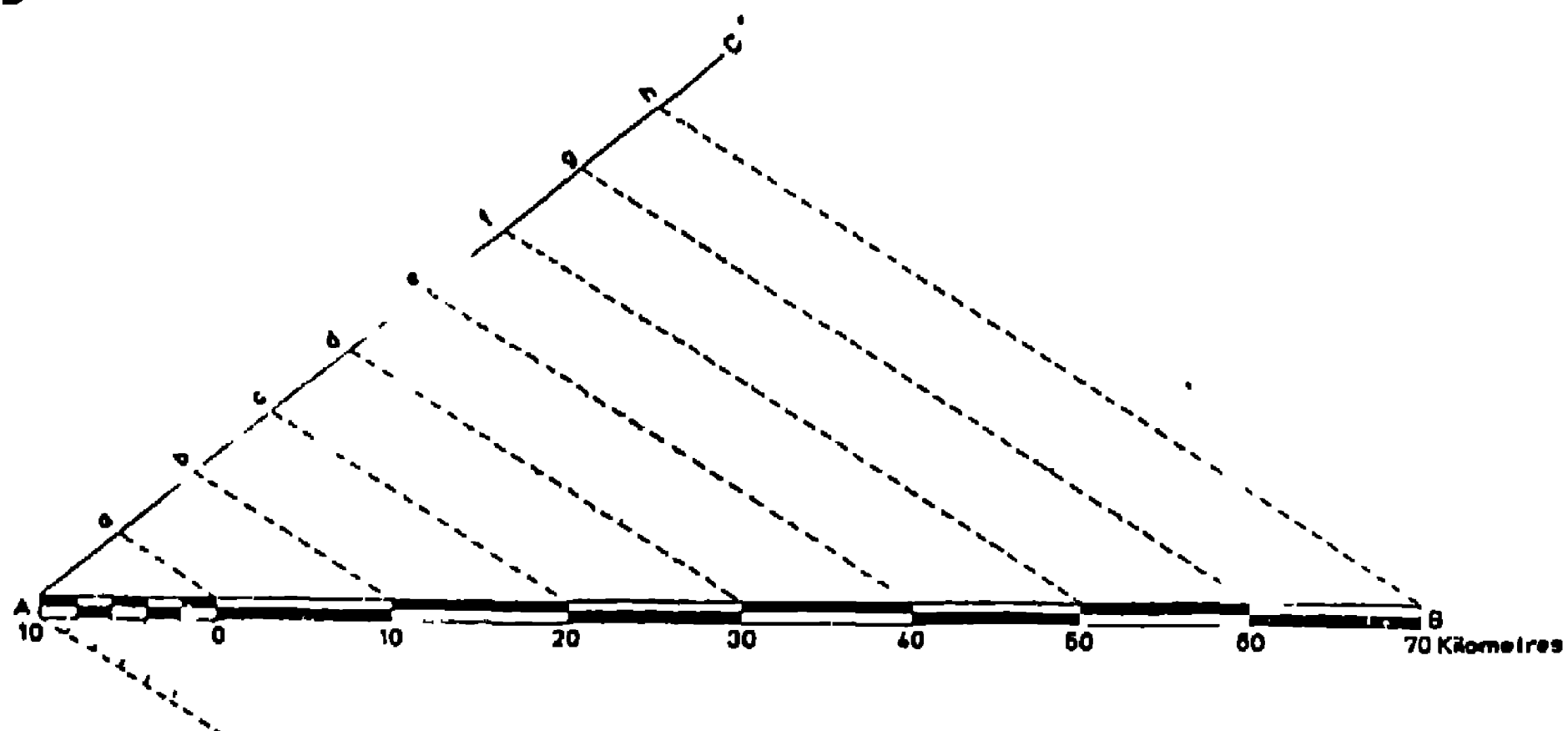


Fig. 5.5: Constuction of Scale

From C draw a line to join B. From other points from the marked points 1', 2', 3' respectively draw parallel

lines to CB so that they divide the given line AB into 15 equal divisions. Let these divisions on AB be 1 2 3 upto 15 respectively. These are called primary divisions.

Now the first division may be further subdivided called secondary divisions using the same procedure in six equal parts to represent 1 km for 1 division. Now the required scale is completed.

Evaluation

- 1 Construct a graphical scale for 1 cm = 25 kms
- 2 Construct a graphical scale for 1 cm = 200 kms

Classification of maps based on the scale used

The maps are classified as small scale and large scale maps depending on the size of the scale used in these maps.

Small scale map

It is a map which represents large areas like countries, continents, etc. These maps are shown in text books, atlases and wall maps. All the geographical details cannot be depicted in these maps. Only selected important details are shown in them like - rivers, boundaries. Small scale maps can also be found in geological maps, meteorological maps, astronomical and navigational charts.

Large scale map

It is a map which represents a small area like a town, city or any required geographical area. Small area is shown which gives more details to study. Example: In a map of a city, settlements, market area, government buildings, roads, parks all such details are given. Topographical maps are large scale maps.

In small scale maps if we show 1 cm = 500 kms, in large scale maps this can be 1 cm = 10 kms

Representation of Relief Features

Relief features means the various types of land forms and their shape and height above the mean sea level. They are also called physical features or topography of the land.

The surface of the earth is not uniform. Various configuration of the land gives us the diversity in landforms like plains, hills, mountains, valleys, plateaus, coasts, deserts, forests, etc. These features have to be represented on the map for easy interpretation and understanding. To represent these physical features many methods are adopted. They are -

1. Hachures
2. Layer colouring
3. Hill shading
4. Form lines
5. Contours

1. Hachures

The height of the land and shape with extent are shown by drawing thin lines continuously for each feature. Such lines are called hachures. But by this method height or slopes cannot be determined exactly. Hence they are not in much use. (Fig 5.6)

2. Layer colouring

Using different colours to represent the different heights of the landforms above or below the mean sea level.

is called layer colouring. Use of different colours and varying tints that is light, very light, dark, very dark on the basis of atlas map which is considered as international standard. (Fig 5 7)

3. Hill shading

Heights of the landforms can be shown by shading the features either dark or light rather than using lines or Hachures. This is a better method but again does not provide any data of heights. In hill shading darker shade represents steepness and lighter gentle slope (Fig 5 8)

Form lines

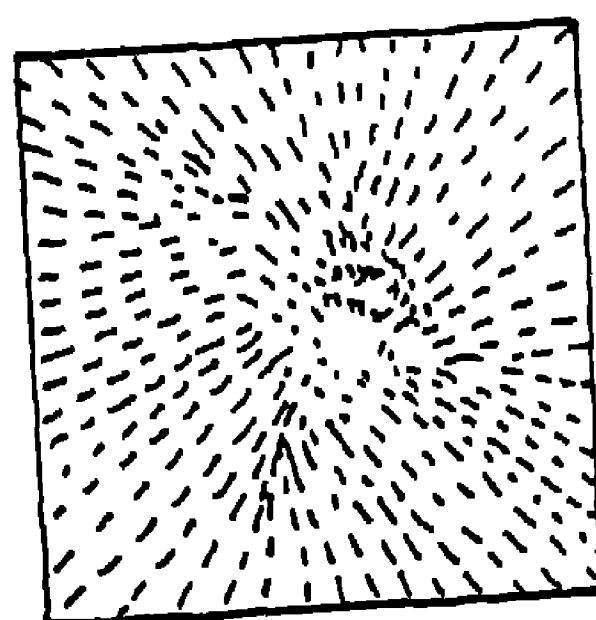
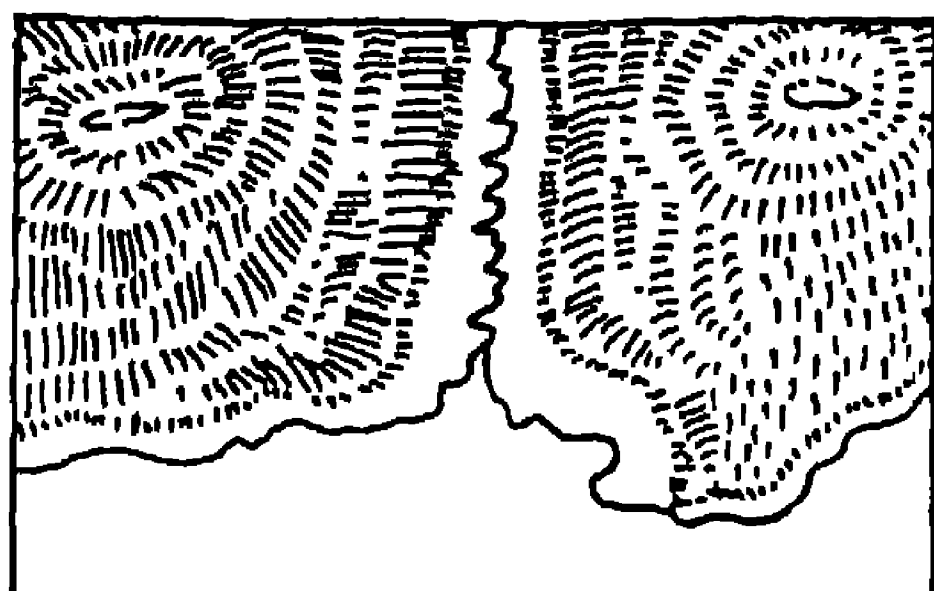
These are broken lines to represent the landforms like hills, plateaus, etc. Like Hachures they do not give us any idea about the height or extent but helps only in identifying a landform (Fig 5 9)

Contours

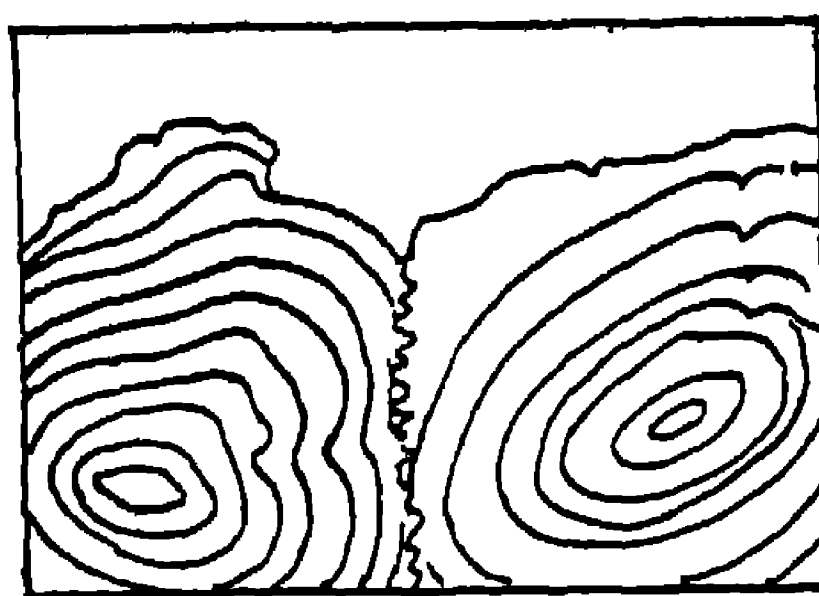
Among all methods by which the relief features of the earth are represented on the map contours are the best and a new method in which all the major defects have been overcome.

Contours are imaginary lines on map connecting places of equal heights above the mean sea level. Contour interval or the gap gives the idea of slope or gradient. If the gap is wide the slope is gentle and if it is less or narrow then the slope will be steep.

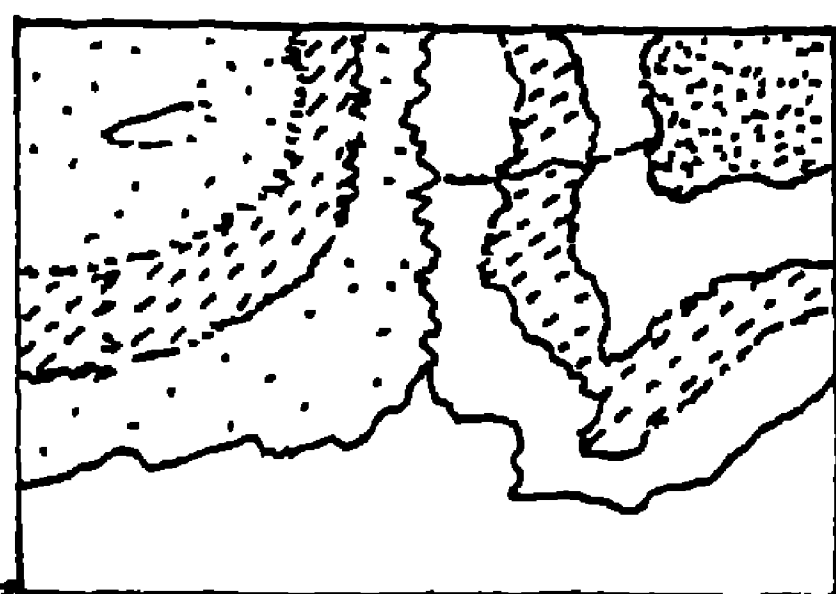
By developing cross sections for contours we can make out the nature of slopes like steep, gentle, undulating



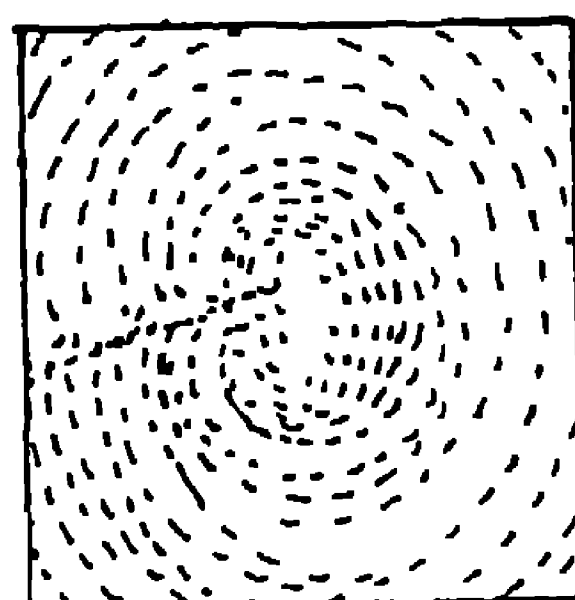
5.6



5.7



5.8



5.9

concave, convex, etc. Every contour gives the height above the mean sea level. All types of features like hills, valleys, mountain ranges, plains, plateaus, coasts, cliffs, etc can be specifically shown on the map with the help of contours. (Fig 5.10)

- | | |
|----|----------------------------|
| 1 | Uniform slope (U S) |
| 3 | Convex slope (C X S) |
| 5 | Undulating slope (U D S) |
| 7 | Plateau |
| 9 | Water fall (W F) |
| 11 | Hanging Valley (H V) |
| 14 | Over hanging cliff (O H C) |
-
- | | |
|----|-----------------------|
| 2 | Concave slope (C S) |
| 4 | Terraced slope (T S) |
| 6 | Conical hill (C) |
| 8 | V shaped Valley (V V) |
| 10 | U shaped Valley (U V) |
| 12 | Spur (S) |
| 15 | Lscarpment (L) |

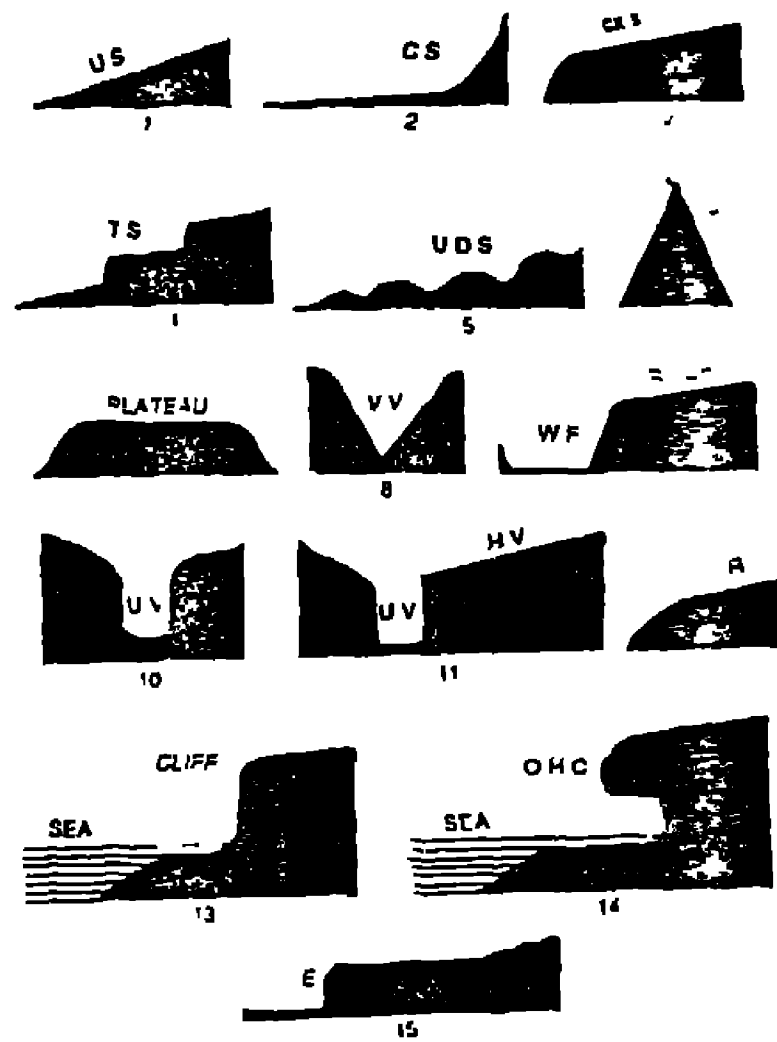


Fig. 5.10: Various Types of Features

Activity 1

Take a big size potato. Cut it horizontally into slices of equal thickness. (Fig 5.11)

Top view of the sliced potato

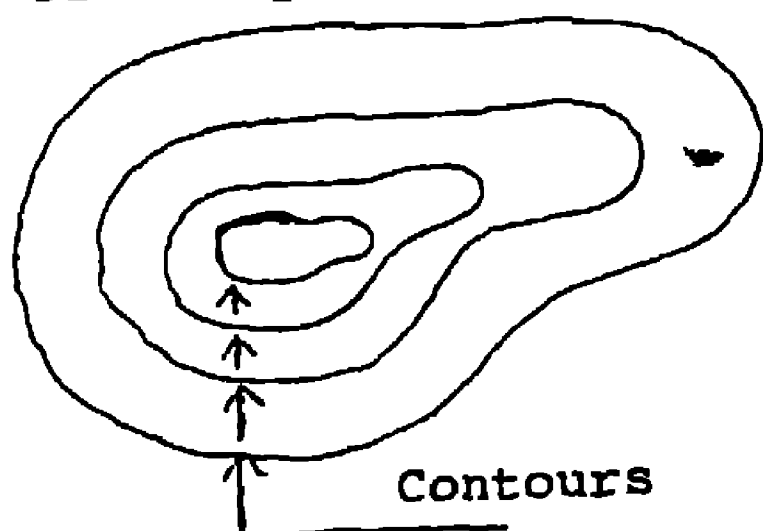


Fig. 5.11: Contour

Sectional view of the potato

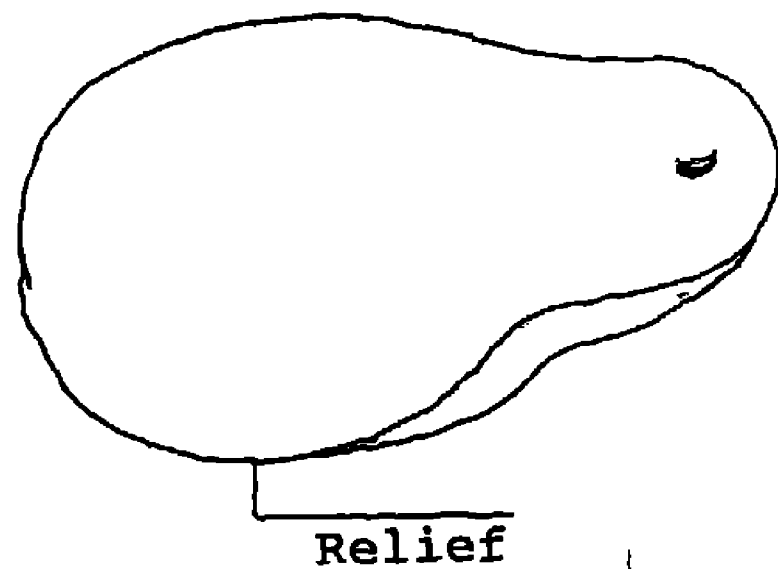


Fig. 5.12: Relief

View it from the top and observe the cut lines on the potato. This can be assumed as contour lines.

To get the front view and also to find out the nature of slopes make a vertical cut so that all the potato slices are cut completely upto the bottom. Remove half of the cut potato (Fig. 5.12)

Now observe the slopes on each side of the potato and edges of each slices. This view can be represented graphically

Activity 2

To draw a cross section to a given contour diagram

The given contour map starts from 50 ft contour and wards at 200 ft. AB is the cross section line which cut across all the contours. (Fig 5.13)

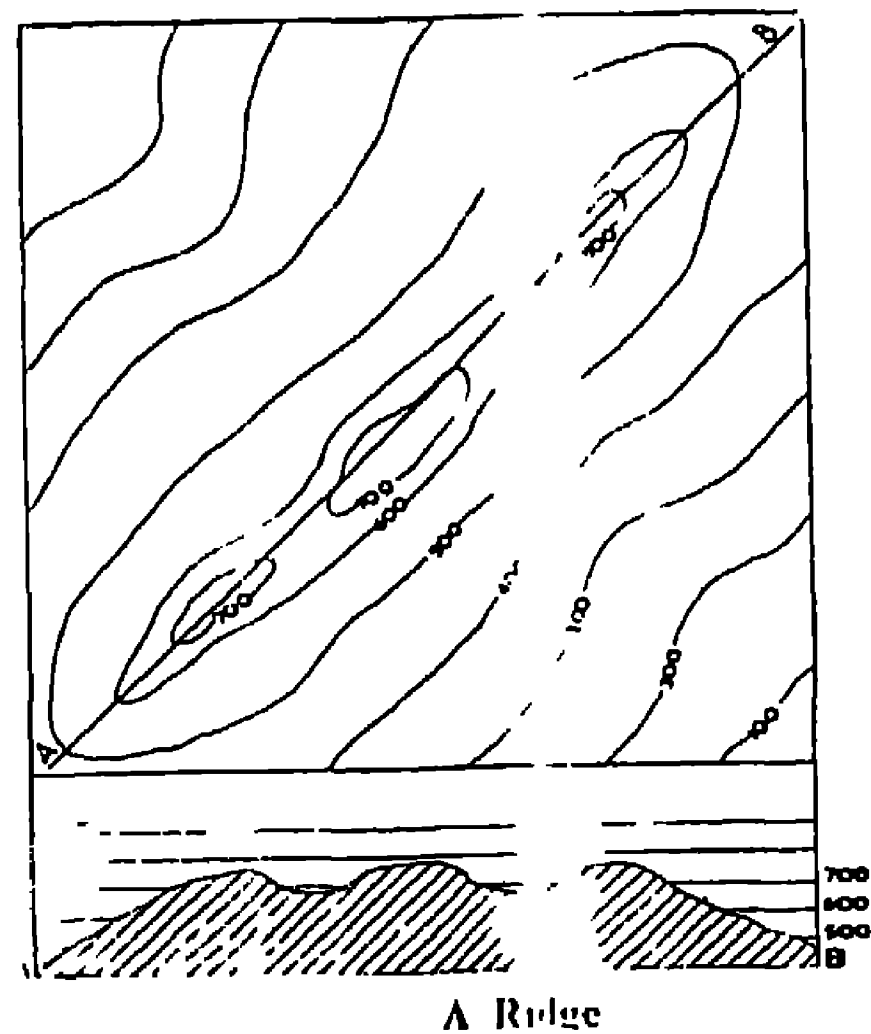
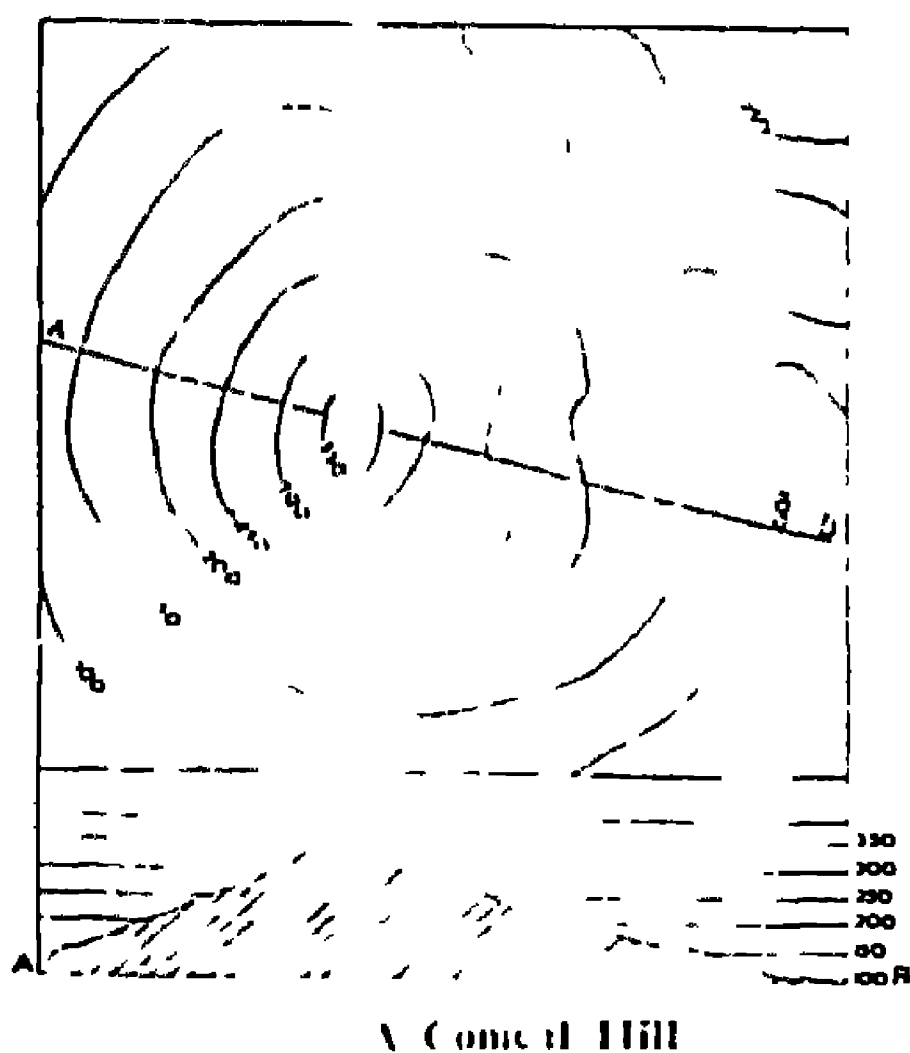


Fig. 5.13: Cross Section of Contours

Draw a horizontal line A, B below the contour diagram. Take any convenient distance or length from the divider and mark 50 to 200 ft on the vertical lines drawn from the cross section line AB. From the points draw parallel lines to A, B, which represents the height.

Draw lines downwards from the points of intersection of contours which cut across the parallel lines drawn to A, B, as in the figure. Mark 50 to 200 on both the sides with the help of vertical and horizontal lines. Join these points with free hand line. This gives a cross section view of the relief feature.

Ex. In the figure it is a hill with uniform gentle slope.

Evaluation Items

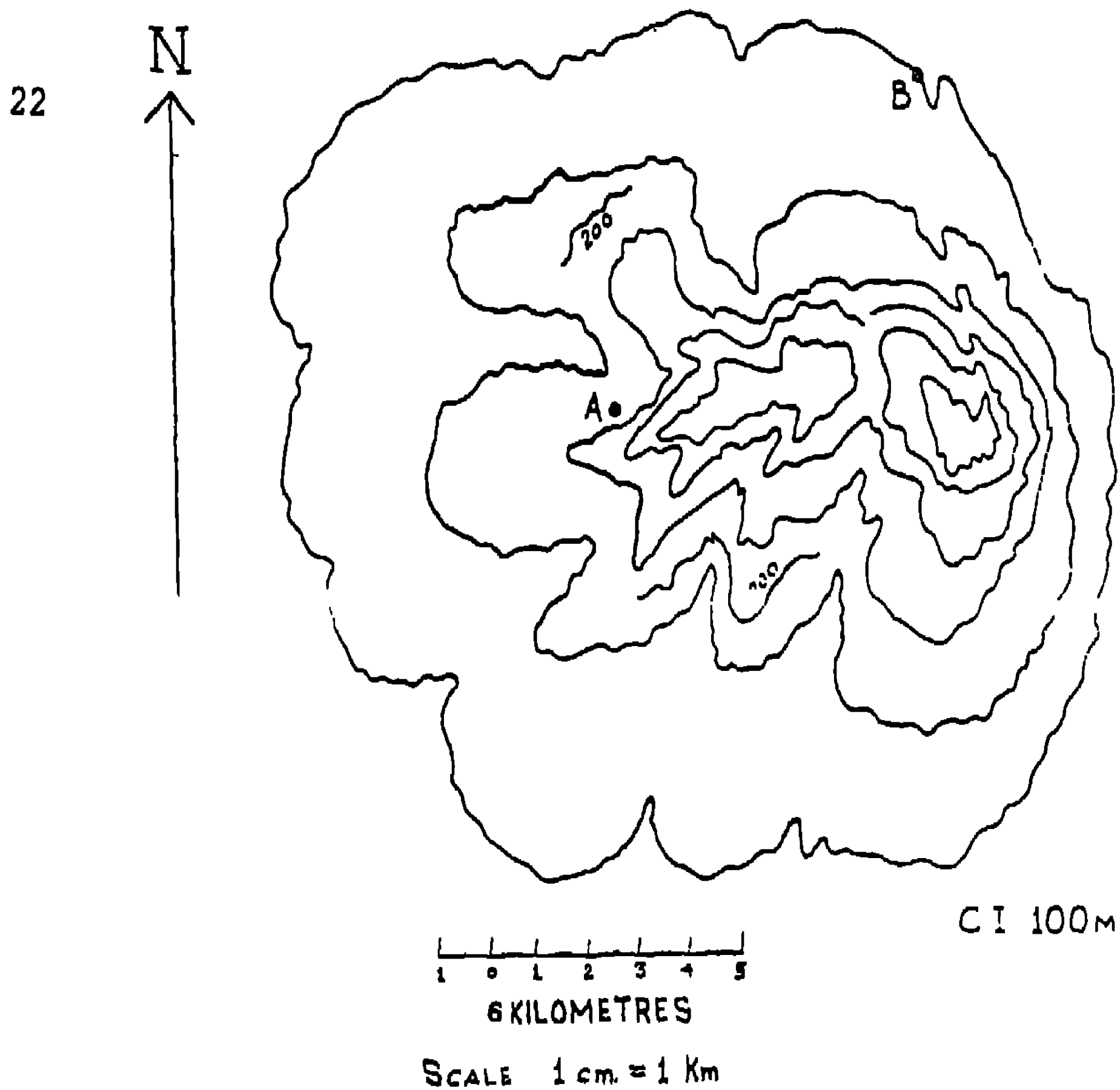
1. What is a map ?
2. List the components of a map and describe the use of any one of those components in reading a map.
3. What is the use of a legend given in a map ?
4. Using the legend given in the physical map of India, find out the approximate range of height of Ganga valley.
5. Mention the basis for classification of maps.
6. What is a direction indicator ? What is its use in reading a map ?
7. Name one state each located in the following directions in relation to Madhya Pradesh.

N.E -

S.W -

8. Why are symbols used on a map ?

9. What are conventional symbols ? Prepare a legend for the conventional symbols used in a transportation map of India.
10. Colours are used in a map to indicate _____
11. Using different shades of colour to indicate relief features on a map is called _____
12. What is the role of 'scale' in a map ?
13. 1 cm = 100 kms is a _____ form of scale
14. Representative fraction is a ratio of _____ and _____.
15. On the outline map of India locate the following with appropriate colours and symbols. Prepare a legend.
 - One textile industrial centre
 - One mineral oil drilling centre
 - Eastern Ghats
 - River Cauvery
 - Shipyard in the western coast
 - Thar desert
 - Delta of River Ganga
 - Bhopal
16. Write the differences between large scale and small scale maps
17. What scale of map is the railway map of India ?
18. Through which scale of map, the city of Chennai is shown with more details ?
19. What are contour lines ? How are they useful in representing relief features ?
20. In what way this contour method is better than hill shading, formulas or Hachures ?
21. Draw a cross section for the given contour diagram.



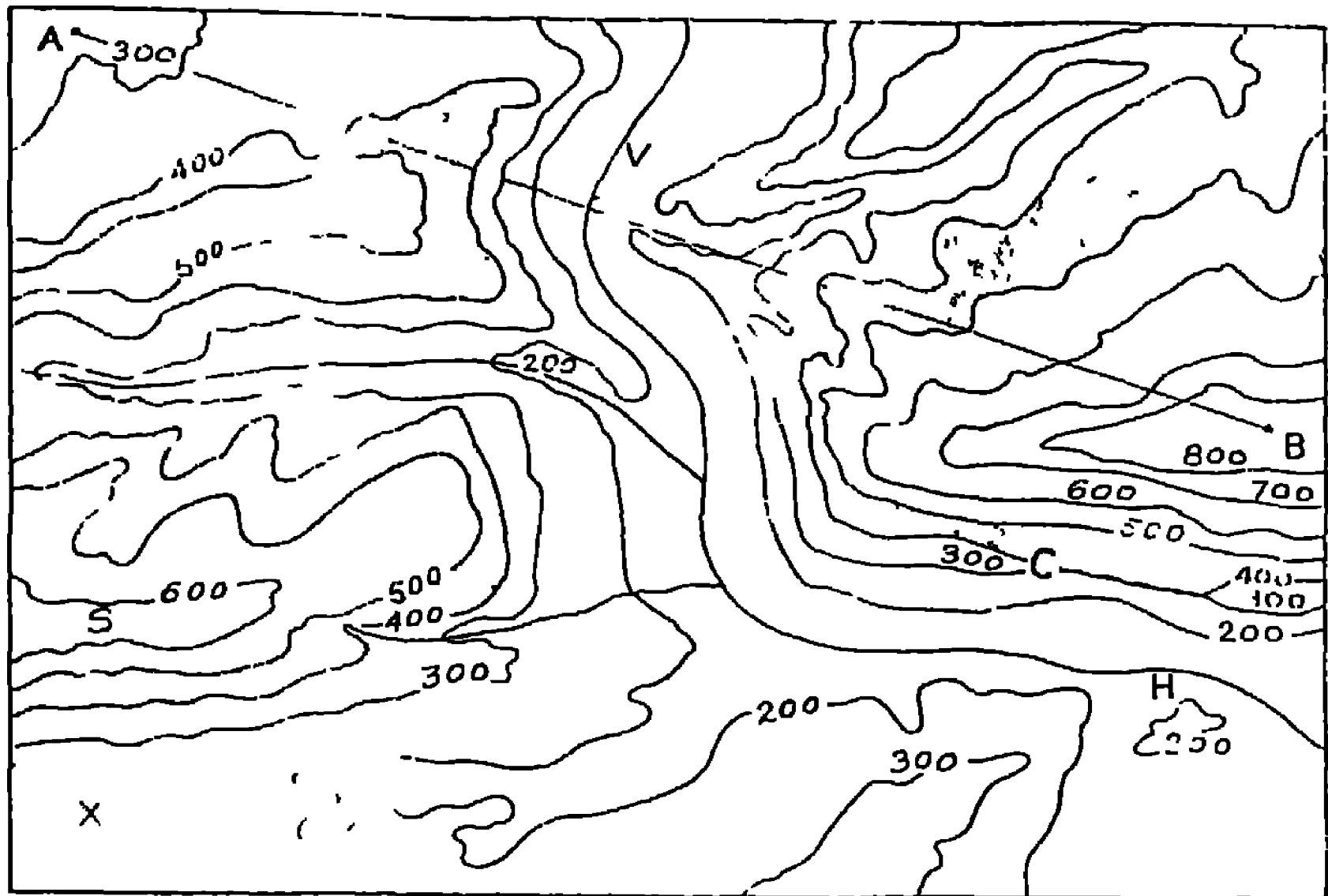
Questions

- A part of 200 m contour is marked Complete this contour
- Shade in pencil the land between 500 m and 600 m
- Insert the course of any one river
- What is the distance in meter between town A and B ?

-200a-

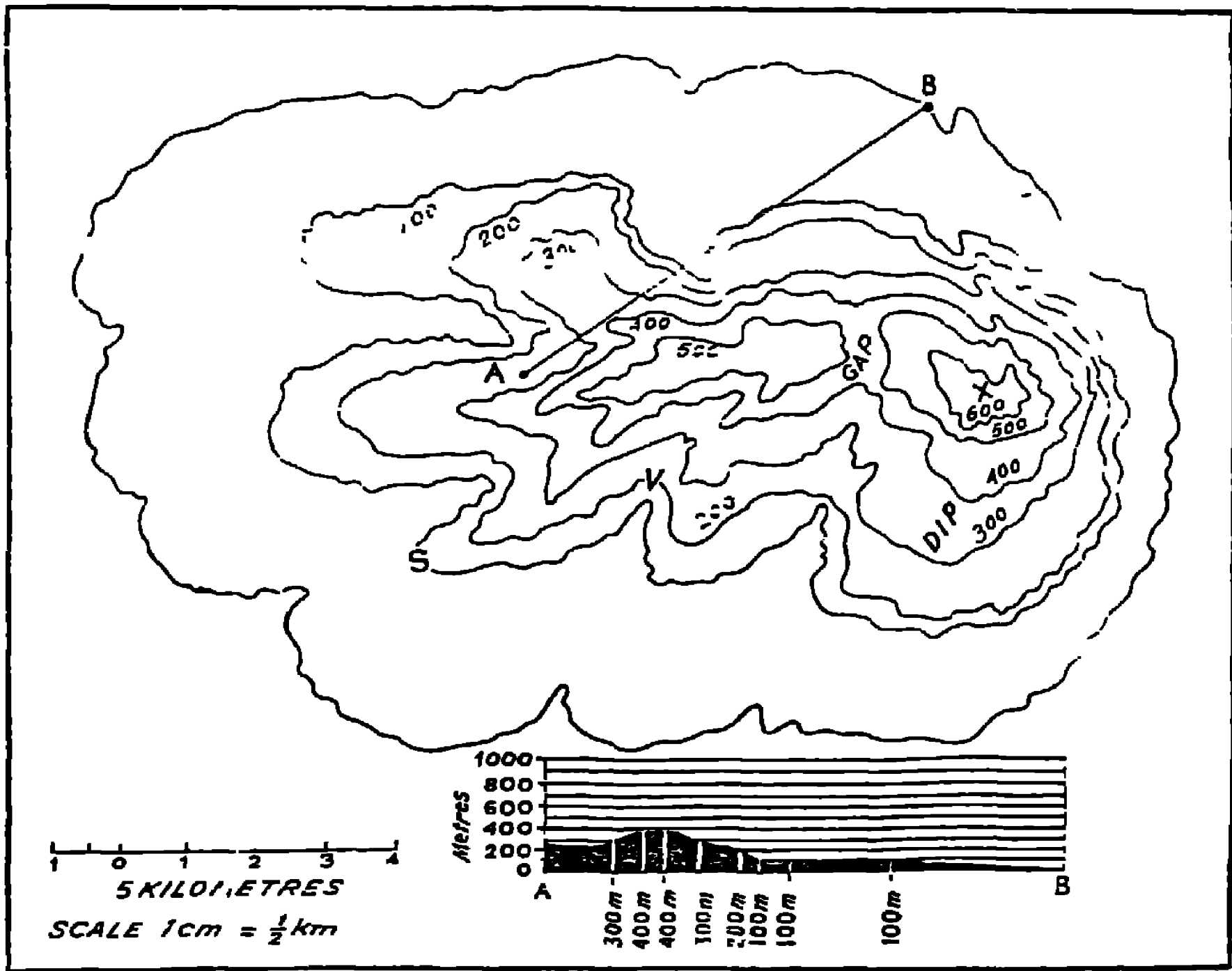
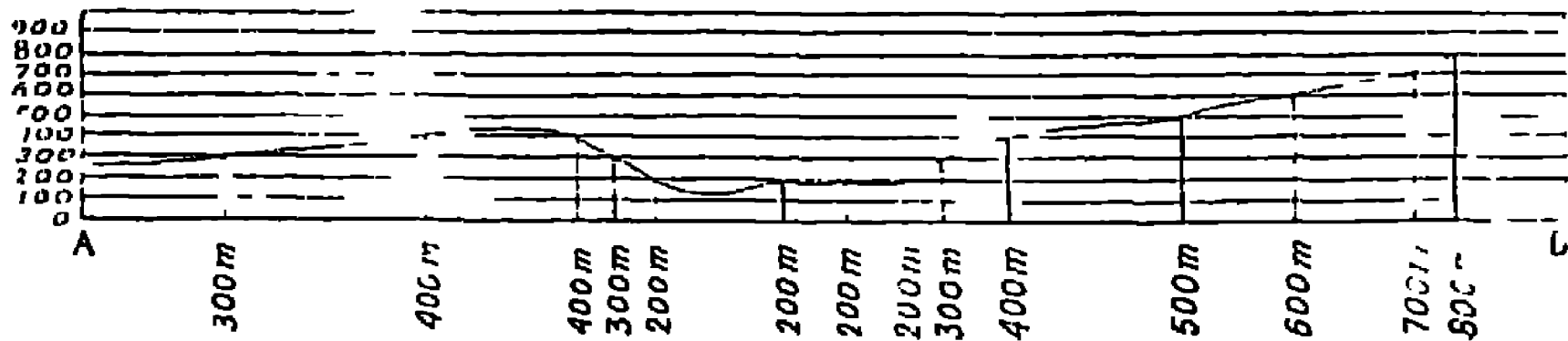


S.O.I. Topo Sheet



METRES

SCALE 1 C.M = 1 K.M



PROJECTIONS

Introduction

Geography is a study of the earth's surface with various natural and cultural phenomena. For this, maps are very essential. To prepare maps, projections of globe have to be made in different perspectives like zenithal, cylindrical and conical.

In this module an attempt is made to make the teachers understand the following

- How to draw latitudes and longitudes on a ball to represent a globe
- Meaning of 'projection'
- Major methods of map projections - zenithal, cylindrical and conical
- Features and uses of modified map projections - Lambert's Azimuthal projection, Bonn's projection, Mercator's projection, the International Projection, Mollweide's projection and Interrupted Mollweide's projection

Instructional Objectives

1. To identify the differences between a globe and a map in relation to their uses
2. To recognise the importance of map projection
3. To identify the change in the form of latitudes and longitudes from globe to a map conical and cylindrical.
4. To draw zenithal, conical and cylindrical projections as per the given procedure

- 5 To identify various modified methods of projection based on their utility.
6. To describe the features and uses of Lambert's Azimuthal Projection
- 7 To define standard parallel
8. To identify the countries/continents which can be studied with Bonn's projection
- 9 To define Rhumbline
- 10 To state reasons for maximum distortion of the earth's surface towards the poles in a Mercator map
- 11 To explain in what way Mercator map is better than Bonn's projection in preparing weather maps
- 12 To explain the problems related to transferring the surface features of the globe
- 13 To list the features and uses of zenithal, conical and cylindrical map projections
- 14 To list the facts that need to be taken care of during map projection.

Concepts

Zenithal projection

The map projection obtained by using a plain paper at different positions on a globe is called Zenithal projection.

Cylindrical projection

The map projection obtained by using a paper cylinder is called cylindrical projection.

Conical projection

The map projection obtained by using a paper cone is called conical projection

Modified map projections

The map projections that have been evolved by various geographers by modifying the map projections in zenithal, cylindrical and conical are called modified map projections. These aim at reducing distortions found in earlier projections to reach perfection in the globe as a map.

Map projections

Features	Uses
Zenithal Sphere is viewed from a point lying either at the centre of the globe, or at the antipode of the central point or at infinity - The line of sight is normal to the plane of projection at the central point - The bearings directions are true and are also called Azimuthal projections - Meridians are shown as straight lines from the centres of the projections - Parallels are shown as concentric circles.	Suitable for showing polar regions
Conical - It is drawn with a cone as its plane of projection. - The meridians are drawn as straight lines diverging from the common centre. - Parallels are drawn as arcs of concentric circles.	Suitable for showing countries lying in the mid latitude areas

Features	Uses
Cylindrical - It is drawn using cylinder on a globe - Meridians and parallels are shown as straight lines	Suitable for showing equatorial regions

Activity

Drawing lines to represent latitudes and longitudes
 (Use a light colour rubber ball and black ink for lines)

Take a rubber ball and pierce with a steel spokes to make two pole points. With the help of a thread measure the distance between the two poles and mark the mid point on the thread. Keep the end points of the thread at the poles and mark the mid point of the thread on the ball. Holding the two end points of the thread at the poles rotate the ball to mark some more mid points of the thread on the ball. Now, remove the thread and join all the marked mid points on the ball. This circular line stands for 'Equator' (Fig 5 14)

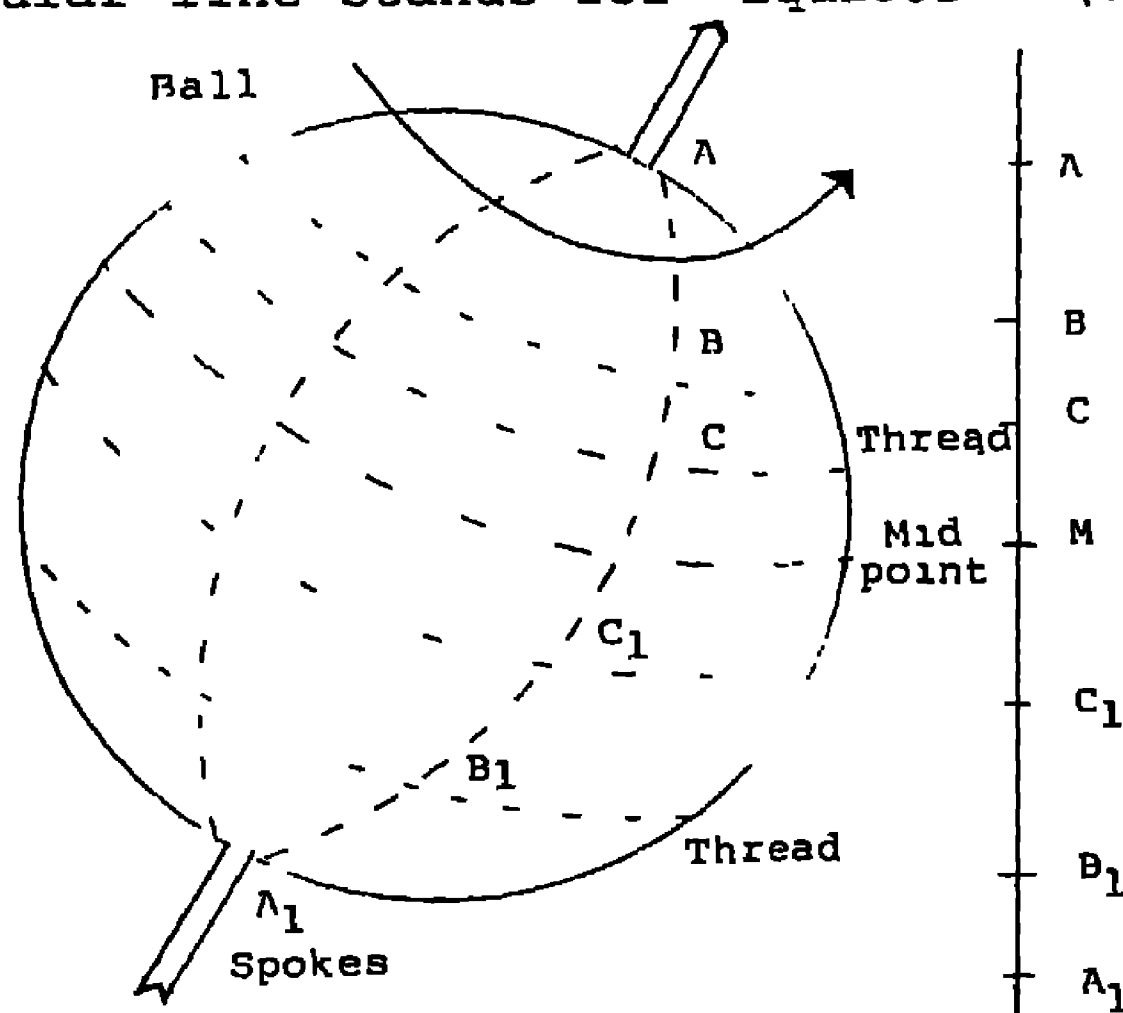


Fig. 5.14: Latitudes and Longitudes

Remove the thread and place it straight on the table and divide the distance between two pole points into six equal parts. Then keep the thread on the ball from A to A, and mark B, C, C₁, B₁ on the ball at different points on the ball by rotating the ball and join all the Bs, B₁s, Cs and C₁s to get four different circles which stand for 23 1/2° and 66 1/2° latitudes on the globe

To draw longitudes, measure the length of equator using a thread on the ball. Remove the thread and place it on the table straightly. Measure it with a scale. Divide the total length of the equator into 12 equal parts on the thread. Then place the thread at the equator on the ball and mark the 12 equal parts on the ball and name each of the points as M₁, M₂, M₃, ... Then draw a line joining A and A₁ passing through M₁. Like this draw as many as 12 lines from A to A₁ through M₂, M₃, ... These lines which join the poles are called meridians of longitudes. One of those lines may be considered as 0° meridian.

Major methods of map projection

Zenithal projection

Take the illuminated globe. Now take a plain transparent sheet and hold it on the top of the globe, so that the horizontal surface of the plain paper touches the pole point. Look from the top, you will find three concentric circles and 12 radial lines which appear like the spokes of a wheel. These lines can be traced on the plain paper as the paper is transparent. You can also draw three

concentric circles with pole point as centre This picture obtained on the transparent sheet represents Zenithal Projection. (Fig. 5 15)

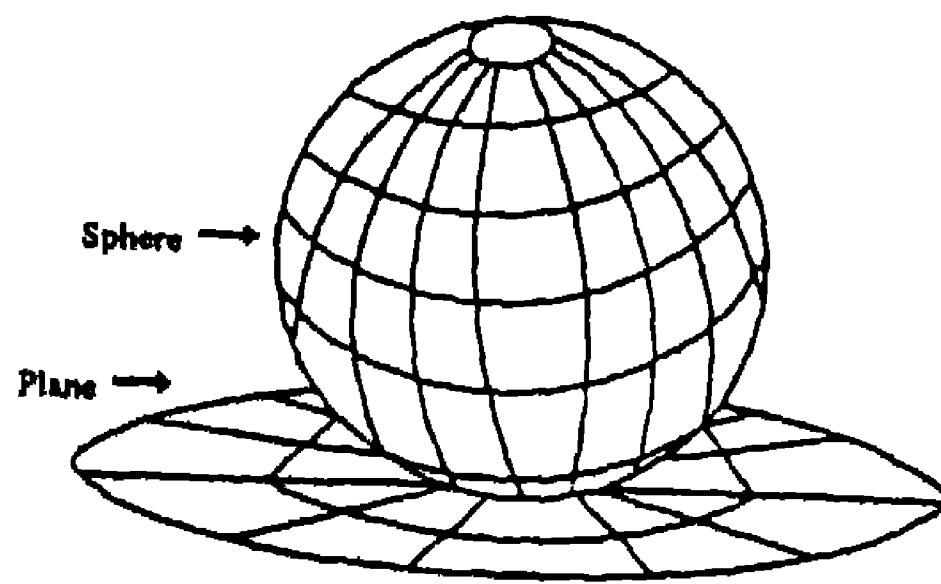


Fig. 5.15: Zenithal Projection

Conical Projection

Take a transparent paper similar to the one used in previous activity

How to make a paper cone ?

Take the slant height of the cone With slant height as radius Draw an arc on the paper from any convenient point Draw a line joining the point with one of the end points of the arc Measure the length of the arc and cut it when it is equal to radius and join the new end point of the arc with the centre point Now fold (using) the paper to the given shape Fold one end of the arc facing down and fold the other end of the arc to meet the first one (other end) Then put a selophene tape to keep the conical shape intact. Take the illuminated globe. Then place the paper

cone on the globe, so that the globe is fully covered as shown in figure 5 16. Observe the latitudes and longitudes drawn on the ball and trace them on the transparent paper cone carefully. Now lift the paper cone and remove the tape. Spread the paper on the table to find Fig 5 16. This is a sample of Conical Projection.

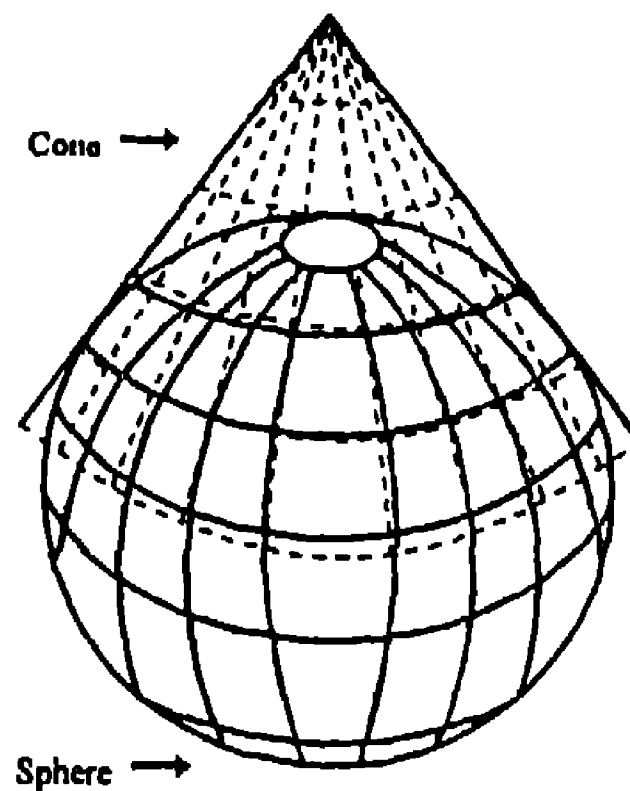
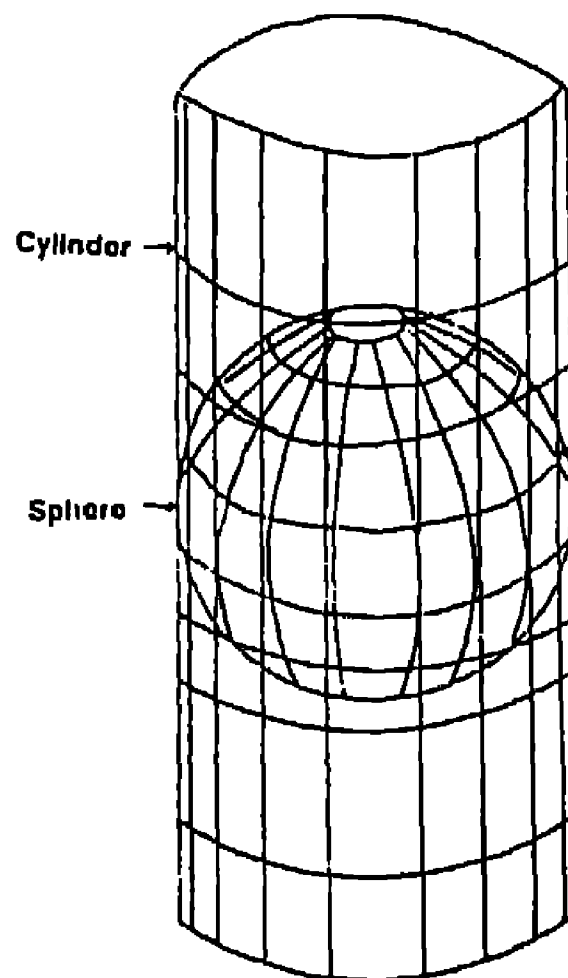


Fig. 5.16: Conical Projection

Cylindrical Projections

Take a transparent paper and cut it in to a rectangular shape $L = D$, $B = D$ ($D = \text{Diameter of the globe} = 3.14$). Fold it to obtain a cylinder whose diameter is equal to the diameter of the illuminated globe and fix the ends with a tape. Push the paper cylinder on the globe, so that the globe is completely covered. Now trace the latitudes and longitudes as done in the previous activity. Unfold the paper cylinder and you will see a rectangle with horizontal

and vertical lines. The horizontal lines represent latitudes and the vertical the longitudes This is a sample of Cylindrical Projection (Fig. 5 17)



Cylinder touches the sphere at the equator

Fig. 5.17: Cylindrical Projection

Activity

With the help of students, after describing the modified important projections and their uses, a data chart can be prepared with the following columns.

Data Chart - Important Projections

Name of the projection	Features	Drawing	Uses

Evaluation

- 1 A projection in which latitudes and longitudes are perpendicular lines is _____
- 2 Latitudes are drawn as concentric circles in _____ projection.
- 3 What is a standard parallel ?
- 4 Zenithal projection represents _____ regions more clearly
- 5 Equatorial regions can be better represented in _____ projection
- 6 The shape of a chicken basket is an illustration for _____ projection

Evaluation Activity

Using the empty Coca Cola bottle perform the activity as per the instructions given in the following figures (Fig 5 18)

Make a map of the earth

- 1 Cut off the top of Cola bottle where the bottle straightens. Cut off the skinny neck of the bottle without slicing through the "globe"
- 2 Draw lines of latitude and longitude on the inside of the globe. Doing this will be easier using a bowl or some other round object to guide the marker
- 3 To represent a planar projection, place the globe on a piece of tracing paper. Hold the flashlight above the globe and shine its light down through the globe and onto the tracing paper. Draw the lines of latitude and longitude as they are projected on the paper

-209a-

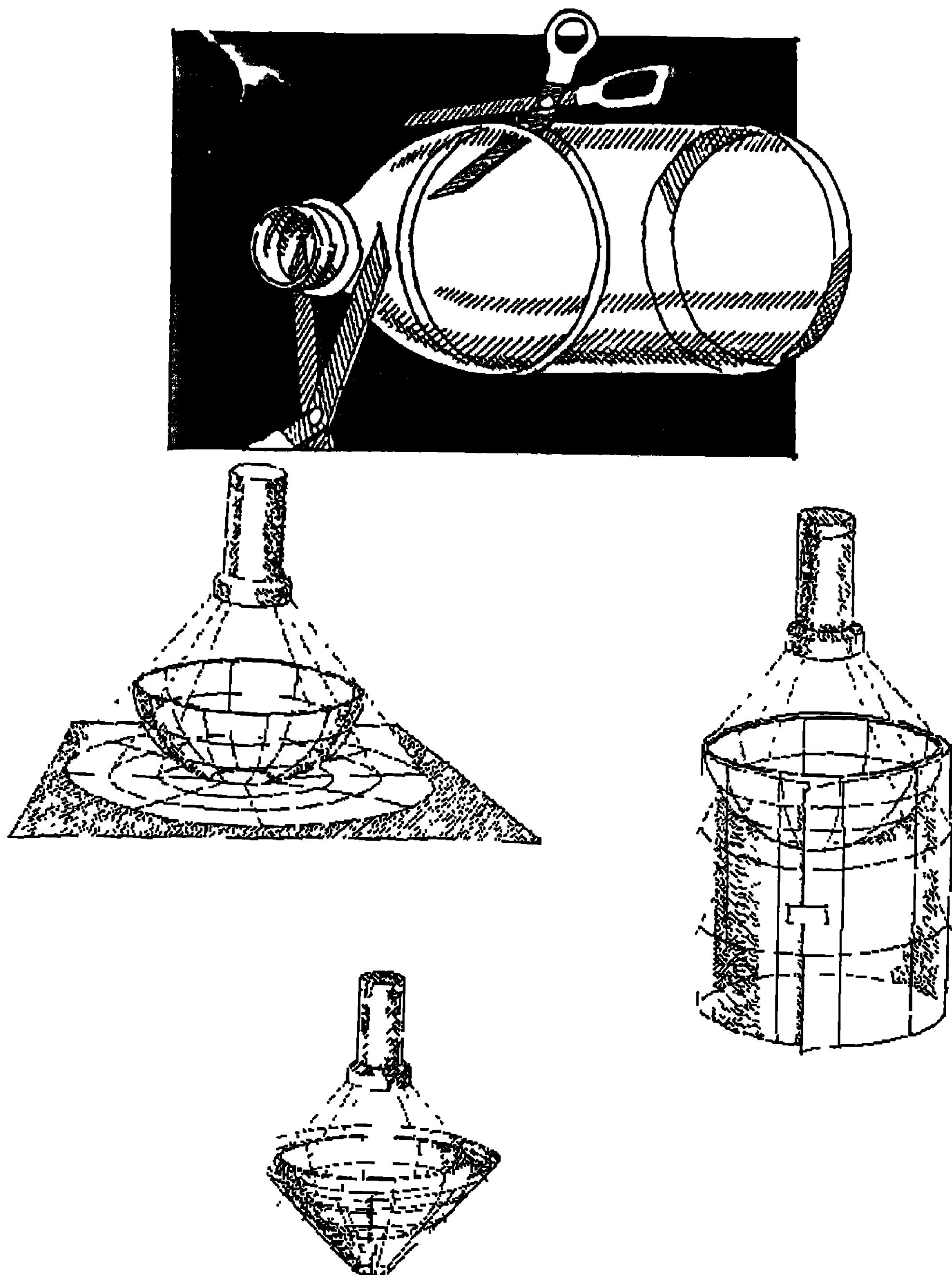


Fig. 5.18

4. For a cylindrical projection, roll the tracing paper into a cylinder the diameter of the globe. Shine the flashlight through the globe and onto the tracing paper. Draw the lines of latitude and longitude as they are projected onto the paper.
5. A conical projection is a compromise between planar and cylindrical projections. Make a cone out of the tracing paper and rest it on top of the globe.
6. Shine the flashlight through the globe and into the cone. Draw the lines of latitude and longitude as they are projected onto the cone.
7. Discuss alternative map-making methods that would minimise the distortions inherent in maps.

Materials

Clear plastic Coca Cola bottle, flashlight, tracing paper, scissors, marker, pen

Lambert's Azimuthal Projection

- Projection is possible only at the south or the north pole
- Equatorial areas are not possible due to distortion and exaggeration

In this projection equator limits the projection hence only the northern and the southern hemispheres can be shown.

Latitudes are concentric circles, they go on reducing towards the poles. Pole is a point.

Longitudes are drawn from the poles towards the equator as straight lines in radial form. Latitudes and longitudes intervals will give the degrees of the globe.

Uses

This projection is useful when polar areas, and the matrix or distribution maps of northern or southern hemisphere. It can be used as political maps

Evaluation

1. Write two special characteristics of this projection
2. Which part of the globe can be accurately represented in this projection ?
- 3 Name any two countries which can be studied with this projection ?

Bonne's projection

It is a modified conical projection. It is assumed that the cone touches the globe at a particular latitude or parallel. This latitude is called "standard parallel". In this projection latitudes are circles and longitudes are smooth curves instead of straight lines. Only one meridian is straight line and it is the central meridian. This projection is based on equal area property. It resembles a chicken basket. (Fig 5 19)

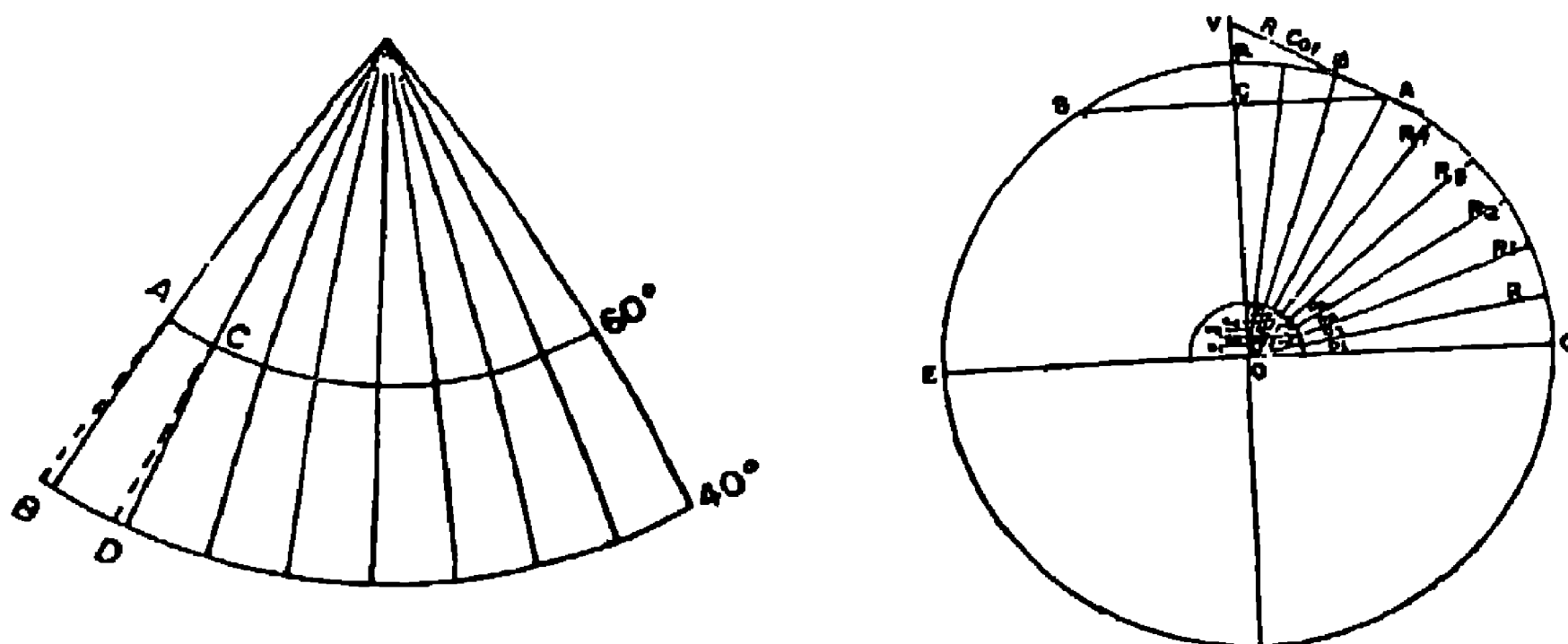


Fig. 5.19: Bonne's Projection

Uses

Used widely in the Atlas and wall maps to show countries of the world separately or continents located in any one of the hemispheres.

Evaluation

- 1 What is a standard parallel ?
- 2 Name the continents which cannot be studied through this projection and why ?

Mercator's projection

It is a modified form of cylindrical projection. It is drawn or projected by using straight lines. Latitudes and longitudes are straight lines perpendicular to one another and longitudes will cut across the latitudes. In this projection the distance between the latitudes increases from the equator towards the pole. Hence there is maximum distortion or exaggeration of areas of the earth's surface towards the poles. Any line drawn on this map (projection) will show the correct bearing or direction and it is called the "Rhumbline". Ex-air route connecting Delhi and New York gives the correct direction (Fig 5.20)

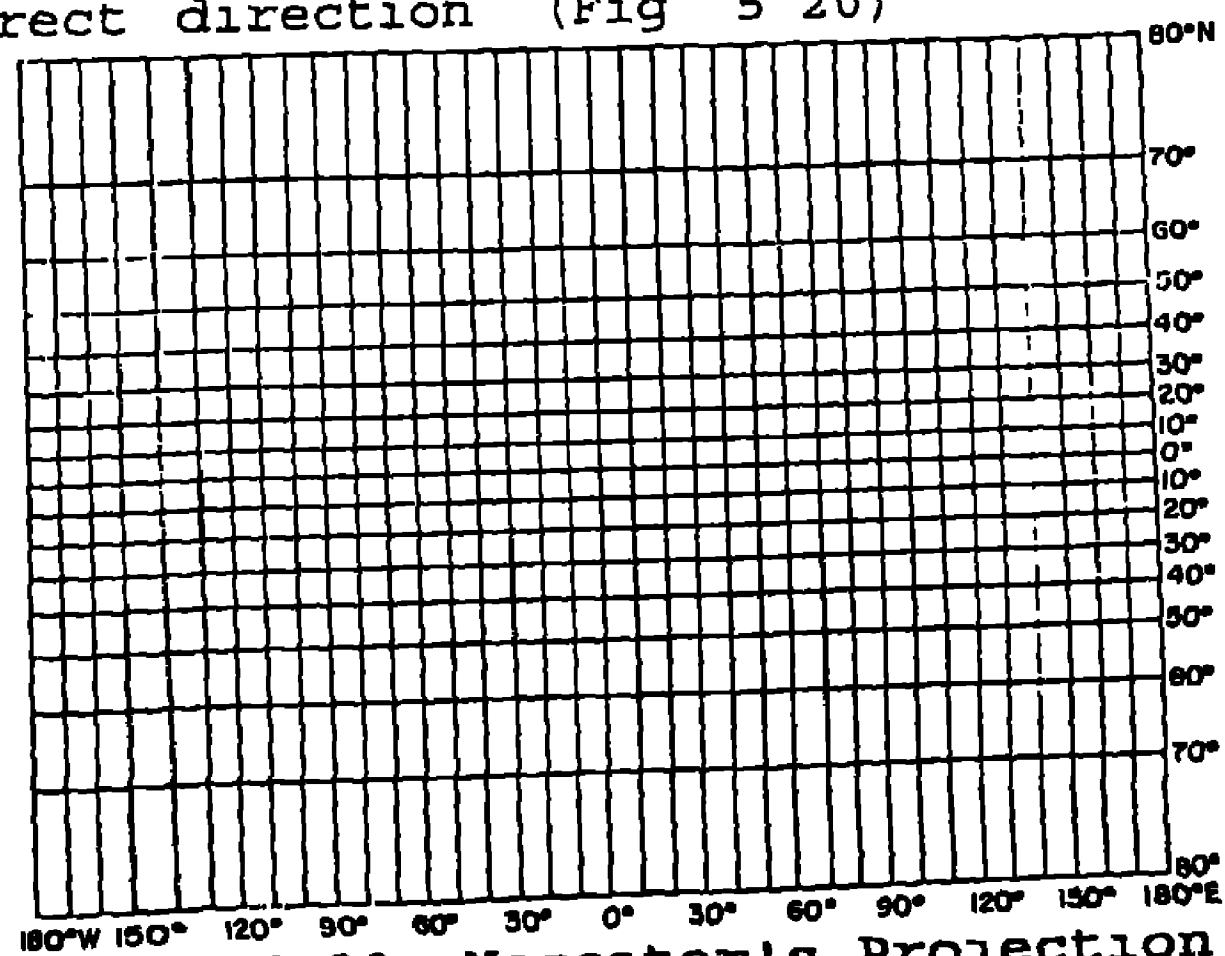


Fig. 5.20: Mercator's Projection

Uses

It is an orthomorphic projection because it maintains correct shape of the lands. It also maintains the correct bearing or direction. Hence it is widely used in navigation. Geographic phenomenon like ocean currents, winds, etc. can be shown on this map. It is used for preparing weather maps.

Ex Indian weather maps

Evaluation

- 1 Which parts of the earth gets distorted to the maximum on the projection ?
- 2 What is a Rhumbline ?
- 3 Why weather departments use Mercator's maps ?
4. Give reason why the size of countries of polar regions cannot be compared with the size of tropical countries in this map ?

The International Map Projection

It is a modified form of poly conic projection.

Poly Conic Projection

In poly conic projection each parallel is projected as a standard parallel. In other words, these parallels have been developed from their own cones. Since the development is from different cones this projection is named as poly conic projection. The parallels in this type of projection are drawn from different centres as arcs. Equator is represented as a straight line because the cone becomes a cylinder, when it is made to touch the equator. Pole is represented as point. The parallels are correctly divided

for spacing the meridians. The projection is neither equal area nor orthomorphic. It is used when individual sheets of the area are to be prepared. It is more useful for preparing map of a small area that is adjacent to the central meridian.

In international map projection the longitudes are drawn as straight lines and parallels are drawn as curved lines. A set of sheets will include projection to cover a wide area. Each sheet is prepared independently. (Fig 5.21)

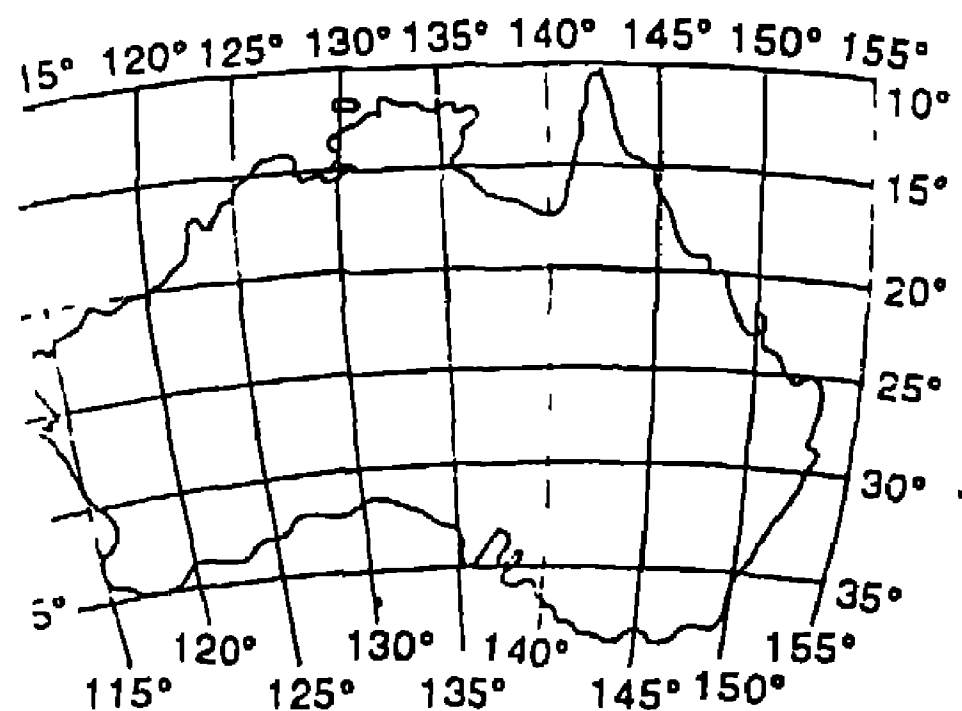


Fig. 5.21: Poly Conic Projection

Evaluation

- 1 What do you understand by poly conic projection ?
- 2 The international map projection is a modified form of projection
- 3 What is the limitation of international map projection ?

Mollweide's Projection

- This projection is of elliptical in shape
- The parallels of straight lines are parallel to the equator. The gap between them decreases towards the pole

- The central meridian is a straight line. Others are curved and intersect the parallels obliquely. Every parallel is drawn to its own scale. It is an equal area projection. It is also called elliptical projection.
- They are more used in Atlases to show distribution maps of the world (Fig 5.22)

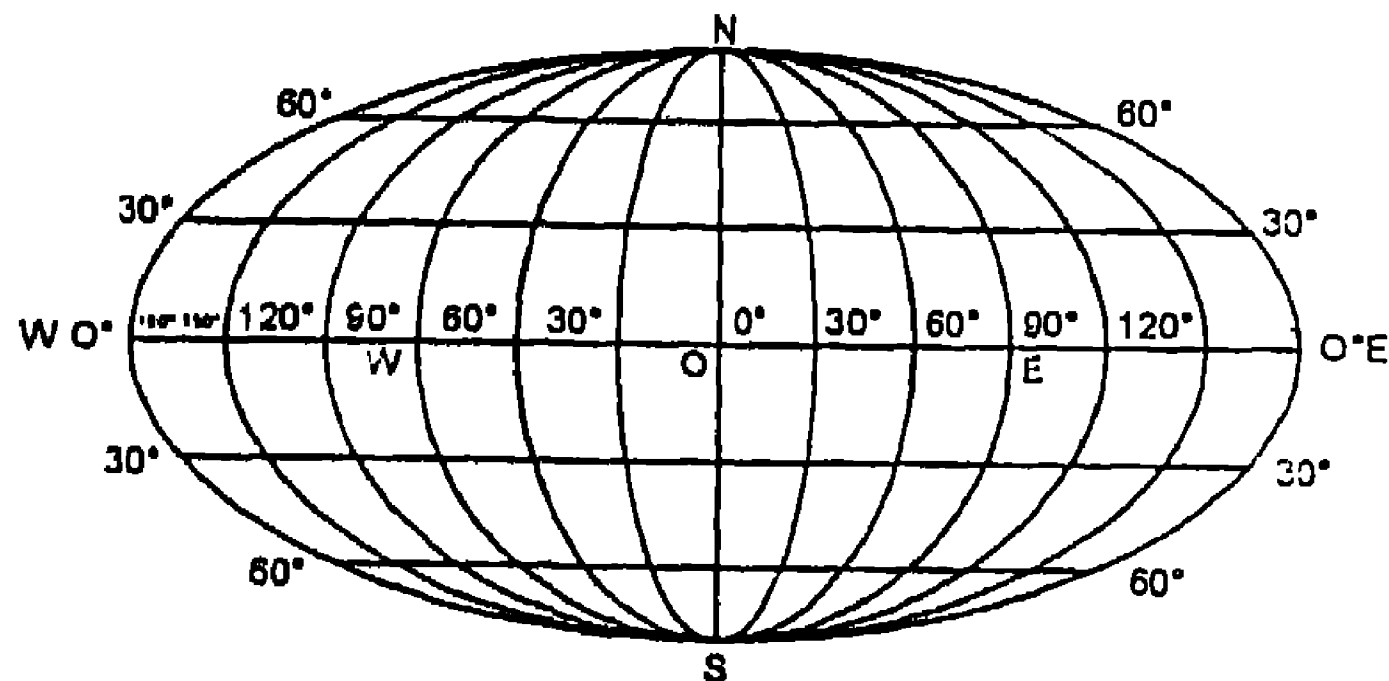


Fig. 5.22: Mollweide's Projection

Uses

The shape of the earth is well maintained. Hence it is used for showing the whole world because of its equal area characteristics. Areas of mid latitudes can be represented than polar and equatorial areas.

Evaluation

1. Which parts of the earth's surface can be better represented on this map?
2. Observing the map projection write two characteristics of latitudes and longitudes.
3. In what way this projection is better than Bonne's projection?

Interrupted Mollweid's projection

The defect in Mollweid's projection namely distortion in shape of landforms is rectified and a modified version of this projection is called interrupted Mollweid's projection. It is also called Homolographic projection. In this several meridians are considered as central meridians hence the areas around this meridian become correct. The required areas can be shown more effectively. Latitudes are not shown continuously due to deliberate interruption. Equator is the only line or parallel which runs continuously.

Uses

Required geographic areas can be represented on this projection.

Evaluation

- 1 What is the defect in Mollweid's projection ?
- 2 How this defect has been overcome in the interrupted Mollweid's projection ?
- 3 How is the interruption shown on this projection ?

RESOURCE TEAM

RIE, Mysore

External Resource Person

- | | | | |
|---|--|---|---|
| 1 | Dr.V Madha Suresh
Lecturer in Geography | 1 | Dr Dr B N Shivalingappa
Lecturer in Geography |
| 2 | Dr G V Gopal
Lecturer in Botany | 2 | Mr M Ragunathan
Lecturer in Geography |
| 3 | Mr D N.Nagaraju, Faculty | 3 | Dr Ms Maria
Lecturer in Geography |
| | | 4 | Mr E Swamiraj Dharmakan
Lecturer in Social Science |
| | | 5 | Mr C.Sambasivam
TGT in Social Science |

DMS, Mysore

- 1 Mr Madhava Rao, PGT, DMS, Mysore
- 2 Ms. Asha K V D Kamath, DMS, Mysore

Participants of the Tryout Programme [Trivandram]

- 1 Mr S Sulaiman, Research Officer, SCERT, Trivandram
- 2 Dr Suhara Beevy S, Research Officer, SCERT, Trivandram
- 3 Smt Chitra Madhavan, Research Officer, SCERT, Trivandram
- 4 Mr. V Sudarsanan Nair, Teacher Educator, Trivandram
- 5 Smt Sosamma P Thomas Teacher Educator, Trivandram

Participants of the Tryout Programme [Pondicherry]

- 1 Mr E Swamiraj Dharmakan, Lecturer, DIET, Pondicherry
- 2 Mr T. Ponnambalam, Lecturer, DIET, Pondicherry
- 3 Mr V.Vinayagam, Social Science Teacher, Pondicherry

II

Schedule of Workshop on Development of Training Package in Geography

DATE	9-11 30 am	*	11 45-12.45	*	2-2 30 pm	*	3 45-5 30 pm
9 11.99	Inauguration Registration		Objectives of the Program Dr.V M Suresh Dr.G V Gopal		Group Work		Group Work
10 11 99	Group Work	B	Group Work	L	Group Work	B	Group Work
11 11.99	Group Work	R	Group Work	U	Group Work	R	Group Work
12.11 99	Group Work	E	Group Work	N	Group Work	E	Group Work
13.11.99	Group Work	A	Group Work	C	Group Work	A	Group Work
14 11 99	Group Work	K	Group Work	H	Presentation of Group work	K	Valedictory Function

Resource Group:

I	II	III	IV	V
ATMOSPHERE	LITHOSPHERE	HYDROSPHERE	BIOSPHERE	MAP PROJECTION
Dr Sivalingappa Mr Sambasivam	Mr M Ragunathan Ms Maria	Mr E Swamiraj	Dr G V Gopal	Mr S Madhav Rao Mr D N Nagaraj Ms Asha KVD Kamath
Edited * Dr V M Suresh	*	*	*	*

III

Schedule of Workshop [Tryout of Training Package in Geography]

Venue o/o Field Advisor, Trivandram

DATE	9-11 30 am	*	11 45-12.45		2-2 30 pm	*	3 45-5 30 pm
6.3.2000	Inauguration Registration		Objectives of the Program Dr V M Suresh	* *	Group Work		Group Work
7 3.2000	Group Work		Group Work		Group Work		Presentation Valedictory

* Tea Break

** Lunch Break

Schedule of Workshop [Tryout of Training Package in Geography]

Venue State Training Centre, Pondicherry

DATE	9-11 30 am	*	11.45-12 45		2-2 30 pm	*	3 45-5 30 pm
9 3 2000	Inauguration Registration		Objectives of the Program Dr V M Suresh	* *	Group Work		Group Work
10 3.2000	Group Work		Group Work		Group Work		Presentation Valedictory

* Tea Break

** Lunch Break

Evaluation Schedule: Tryout Programme [average scores*]

Content	Sufficiency	Error	Clarity	Logical Sequence	Appropriateness
Content	4	4	5	4	4
Instructional Objectives	5	4	4	4	4
Concepts	4	4	4	4	4
Development	4	4	4	4	4
Evaluation	5	4	4	4	4
Figures / Diagrams	5	4	5	5	4
Over all Presentations	4	4	4	4	4

* 5 point scale

Address of the Resource Persons

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3	Dr B N Shialingappa Lecturer in Geography University of Mysore-6	T 48 V Cross Manasagangotri Quarters Mysore-6
4	Mr D N Nagaraju Computer Cell, RIEM	# 39, II Cross, II Main, RIE Layout Bogathi II Stage, Mysore 6
5	Mr S Madhava Rao PGT, DMS, RIE, Mysore-6	# 8/4 II Cross, K R Vanam, Mysore-8
6	Ms Asha KVD Kamath DMS RIEM	#34, 'Vidyashree' RIE Layout
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10	Mr C Sambasivam SGT, Vivekanatha GHSS Villianur Pondicherry-605110	Plot # 6, 'Green Gardens' Kottupalayam Pondicherry-605108